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The OIL AND GAS JOURNAL

41

BRUARY 24
1938

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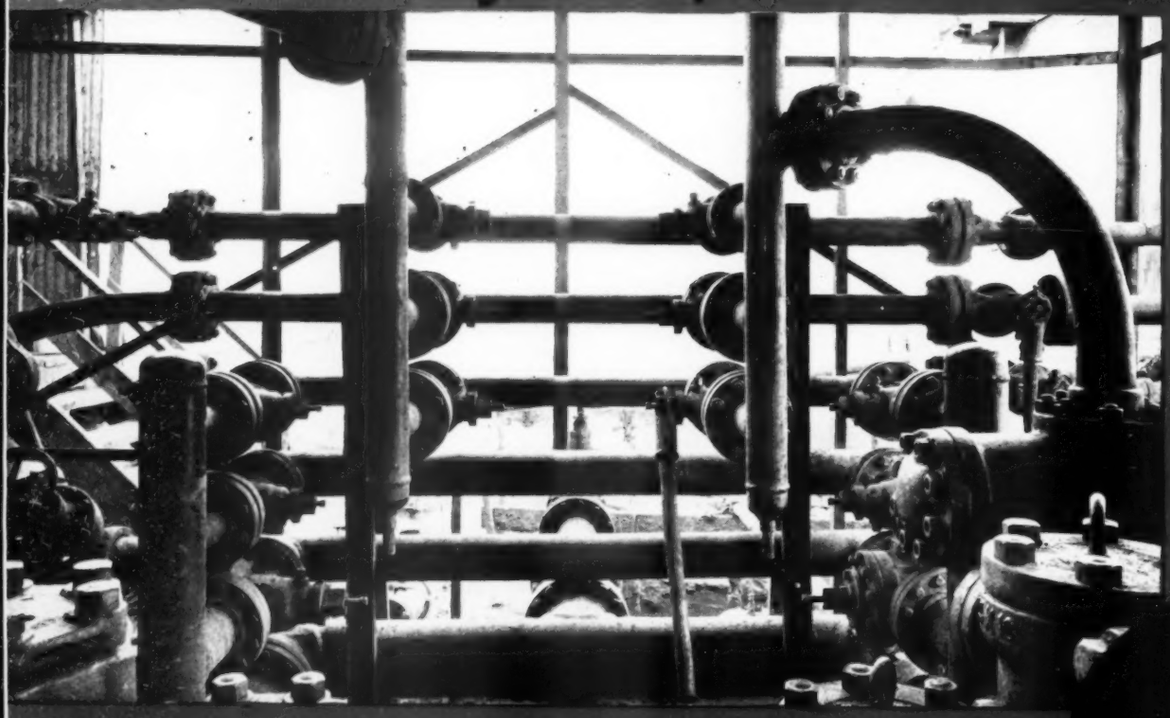

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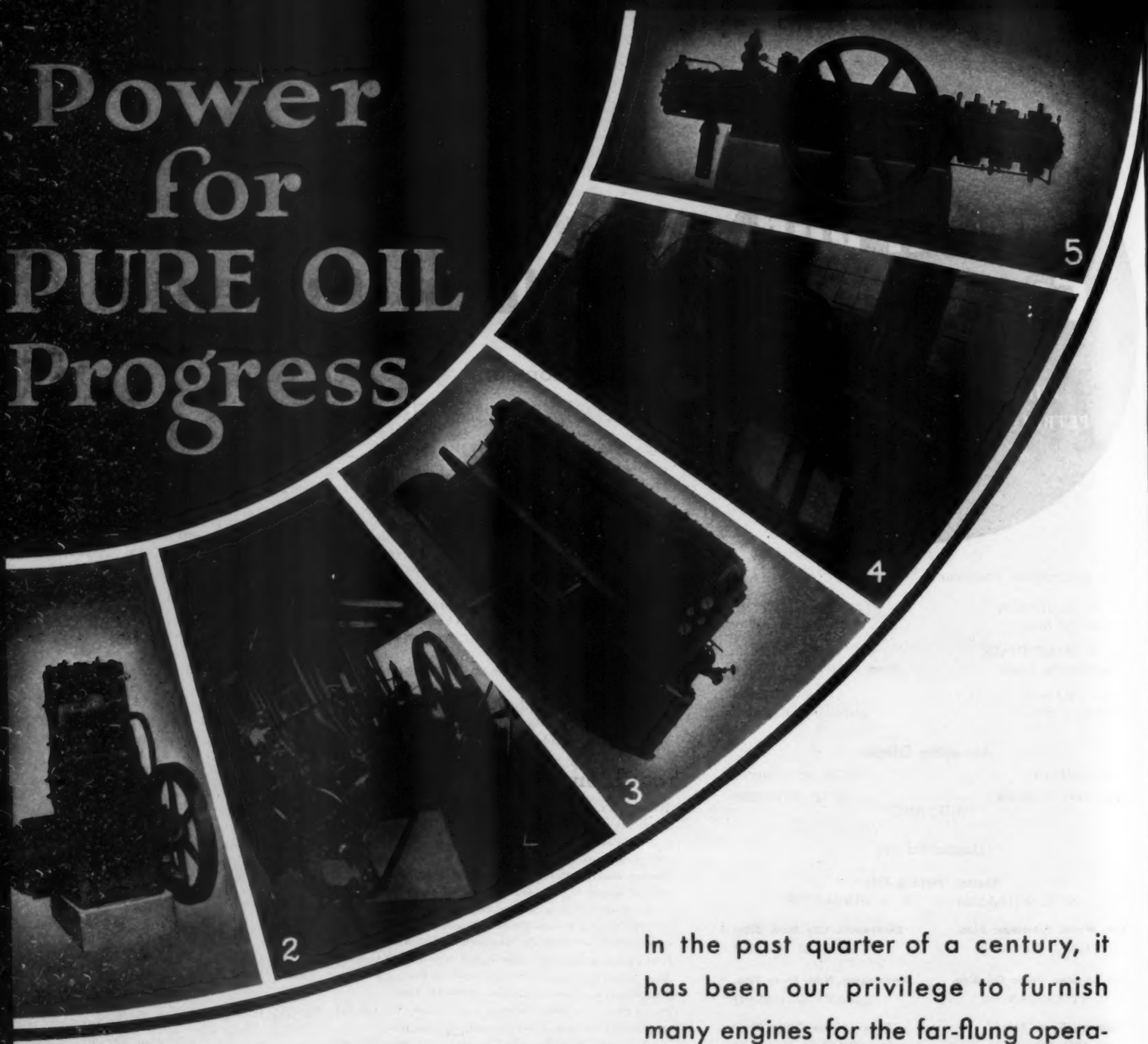
Power for PURE OIL Progress



- Pure Oil Company's production in Illinois has called for many of these Type G-SD, 40 to 60 hp, vertical gas engines.
- G-AW twin-cylinder gas engines, rated 100 to 140 hp, are used by The Pure Oil Company to drive pumping powers in many of its fields.
- Type JT, 6-cylinder, Diesel engines, rated 300 hp at 327 rpm, drive duplex reciprocating pumps at the Toledo and Heath, Ohio, refineries.
- Five of these Type G-DQ, 150 hp, twin-cylinder gas engines, drive naptha and hot-oil pumps at the Toledo refinery.
- Type G-MG, gas-engine-driven compressor units, rated 50 hp at 300 rpm, operate in The Pure Oil Company's Van, Texas, stations.

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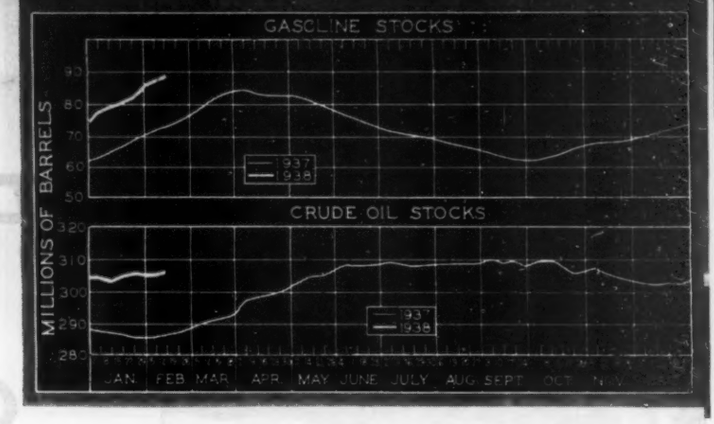


To Curtail March Production

ENCOURAGED by betterment in the industry's statistical and market positions, state proration bodies, with the support of a large majority of operators, will endeavor to bring about further improvement during March. Present conditions have been analyzed and requirements for March are being projected, taking into consideration not only the probable consumption of that month but also the reductions necessary to offset the excess output of fields and refineries in recent weeks.

CRUDE PRODUCTION *3,368,242 barrels daily average—up 44,643 barrels.*

CRUDE STOCKS *304,915,000 barrels as of February 12—up 421,000 barrels.*

GASOLINE STOCKS *87,813,000 barrels as of February 12—up 1,329,000 barrels.*

REFINERY RUNS *3,150,000 barrels daily week ending February 12—down 5,000.*

It is apparent that little attention can be paid to Bureau of Mines recommendations in March. The bureau has recommended the same crude output as in February for Louisiana, New Mexico, and Kansas, with a 20,800-barrel daily decline for Texas and a decrease of 22,000 in Oklahoma. All the details of the bureau's estimated demand for March have not been announced, but it is certain that the crude production recommended for the five principal states, outside of California, is too high.

Oklahoma is considering a reduction to 450,000 barrels daily in March, that being the quantity which crude-oil purchasers have indicated they will require. Texas probably will have to continue the Sunday shutdown or its equivalent through the month with the view of keeping its daily average production around 1,250,000 barrels daily. In the remaining states crude purchasers have indicated their intention of curtailing pipe-line purchases if the state proration bodies do not make adequate adjustments.

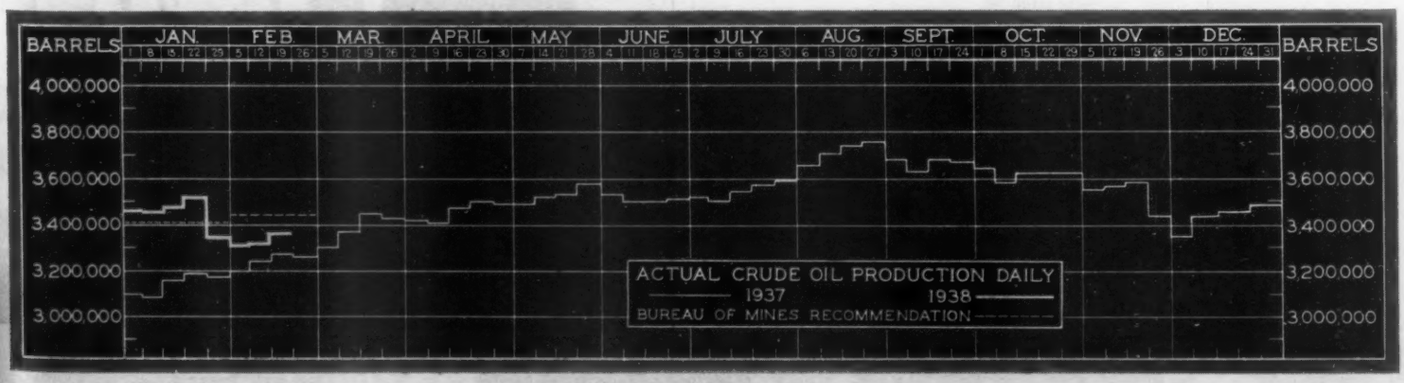
Regarding the demand for finished products, March invariably brings increases in the domestic demand for gasoline compared with February, the low period of the year. Those in close touch with conditions, however, are recommending that refiners ignore this seasonal gain in demand for the principal product in their plants' operations. In the first place there can be little if any addition to gasoline storage during March if a healthy inventory situation is to be attained by the end of the month. Second, the industry generally is ending the main fuel-oil consuming season with much more oil in tanks than it had a year ago. Latest A.P.I. reports reveal that the gain is approximately 19,000,000 barrels. These fuel-oil and gas-oil stocks of 119,293,000 barrels on February 12 were 5,000,000 greater than at the start of the season last September.

The evidences of improved market conditions are nothing to get excited about at this time. They do indicate a turn which can be sustained if the statistical situation shows further improvement. A better tone is apparent in refinery gasolines.

Daily Average Production for Week

	Feb. 19 1938	Bur. Mines Feb. est.	Feb. state allowables	Feb. 12 1938
Oklahoma City	117,200	.....	.....	100,000
Fitts	65,025	.....	.....	64,175
Remainder of state	350,075	.....	.....	346,950
Total Oklahoma	532,300	569,700	500,000	511,125
East Texas	425,048	.....	.....	424,650
West Texas	178,650	.....	.....	178,000
North Central Texas	90,446	.....	.....	90,699
Texas Panhandle	71,897	.....	.....	60,900
East Central Texas	89,898	.....	.....	91,498
Gulf Coast Texas	299,504	.....	.....	294,100
Southwest Texas	100,398	.....	.....	95,753
Total Texas	1,255,841	1,365,700	1,200,000	1,235,600
North Louisiana	77,085	.....	.....	78,595
Gulf Coast Louisiana	176,700	.....	.....	176,750
Total Louisiana	253,785	239,400	244,700	255,345
California	740,250	693,700	693,700	738,250
Kansas	178,800	176,400	176,400	179,300
Arkansas	48,070	36,800	.....	47,120
Eastern fields	138,600	130,000	.....	136,800
Michigan	50,846	52,800	.....	50,319
New Mexico	105,090	105,100	101,100	105,030
Rocky Mountain area	64,660	68,600	.....	64,710
Total United States	3,368,242	3,438,200	.....	3,323,599

Increase, 44,643 bbls. daily.



Modern engine-powered pumping unit

Producers Focus on Cutting Cost

By W. T. ZIEGENHAIN

As the demand for crude oil grows each year, it becomes increasingly important for the industry to be able to produce that oil in the most efficient and economical manner. Important changes in the methods of lifting oil have come about in recent months. These reflect the improvements in equipment design and in better application of engineering principles. The effect has been to add millions of barrels of recoverable oil to the industry's reserves.

In some instances the improvement has been a more economical method for producing the oil, while in others the improvement permits oil to be pumped from greater depths, or it might operate to recover a higher percentage of oil from a field. Regardless of the manner, these developments in their entirety tend to fortify the industry with continued low-price crude oil. The general interest shown in new and improved lifting or pumping practices justifies the belief the industry has reached a point in its economic development where it is of greater importance to bring the oil it has in reserve to the surface at a reasonable cost than to find new fields.

Of course, the drill and the pump must continue to serve as companion tools, but for the time being it seems apparent operators are paying more attention to the pump.

For this reason The Oil and Gas Journal has assembled its "Production issue" in which typical modern production practices are described and, for purposes of close analysis, the material has been chosen to reflect the practice in every major oil-producing area in the United States. Special study has been made of the field conditions in each of these areas for the purpose of suggesting the market for pumping equipment during the current year.

From these studies it appears that in excess of $41,000,000 will be spent within proven areas for pumping and lifting equipment in 1938. The equipment to be used in fields to be discovered in 1938 will call for additional expenditures, so the total will be well in excess of $50,000,000.

Following is a table in which is shown the estimated expenditure for equipping wells in every important proven area. An elaboration of these data is included as an insert opposite page 96.

State or district—	Number of wells to be equipped	Estimated expenditure in 1938
California	843	$3,133,800
Illinois	78	350,000
Indiana	20	100,000
Michigan	390	2,925,000
Kansas	1,710	8,550,000
Eastern states	3,765	1,129,500
Western Kentucky	164	730,000
Oklahoma	1,151	5,383,500
North Louisiana and Arkansas	435	2,000,000
New Mexico	255	1,500,000
Southwest Texas	691	2,118,500
Lower Texas Gulf Coast	265	850,000
Upper Texas Gulf Coast	258	1,158,000
Louisiana Gulf Coast	126	689,300
West Texas	815	3,000,600
Central and East Texas	2,740	5,031,000
North Texas and Panhandle	1,086	2,715,000
Total	14,742	$41,264,200

From a study of the details one conclusion seems to be that the oil industry is not ready to abandon a large number of low-output wells. Instead, the industry is seeking to maintain their operation by adopting one or another type of equipment offered. To this end, many pumping units or lifting devices have been designed and the industry now finds available for its use a new method and type of equipment capable of handling practically any of the many field conditions encountered.

Where there is ample gas, one class of lifting and pumping device is available, and where there is a shortage of gas another group may be given favor. Similarly, if electric power lines supply current in the field under study, the use of electric motors as prime movers is immediately suggested in every modernization program, and it must not be overlooked that important installations of field power-generating plants are being made by oil companies. The latter are especially favored where the oil-producing company controls a relatively large group of wells, where fuel is available at comparatively low cost, and where power-generating equipment may be installed that can be moved to a new location when the time comes to abandon the field.

California

The number of California wells to be equipped for pumping during 1938 will depend to a considerable extent upon how successful wildcatters are in discovering shallow pools or in extending the limits of the known pools. There were 1,164 well completions during 1937. Most observers believe there will be a greater number of completions during 1938, but since the average drilling will be deeper, the flowing life of the wells completed probably will be longer, and not as many wells will be completed as pumpers as last year. However, this condition will be offset by the fact that many fields showing decided drops in pressure, notably Wilmington and Kettleman Hills. Kettleman North Dome and other fields show serious water encroachment. These factors are expected to end the flowing lives of many wells during the year.

To some extent the number of wells in the Wilmington field which will require pumps will be determined by the success of proration. If production is not controlled, a short flowing life is predicted for the majority of wells in this field. The number of completions in Santa Maria Valley will depend on demand for the heavy oil produced. Many of the wells in this field are completed as pumpers.

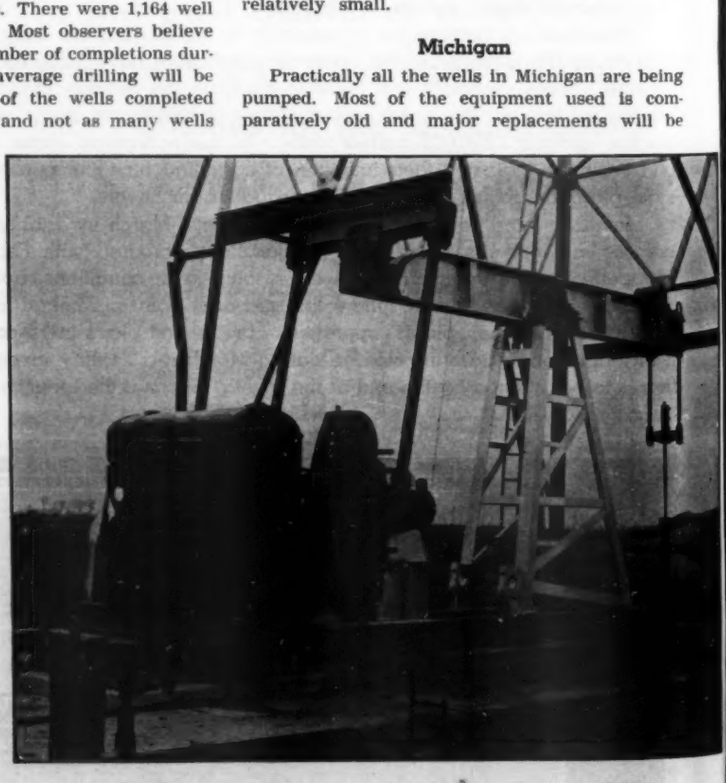
In the newly discovered deep valley-floor fields, such as Greeley, Ten Section, Rio Bravo, and Canal, the wells are expected to flow without difficulty for a long time at present producing rates. However, it is probable that in the course of development some edge wells will be drilled which will require artificial production methods.

Illinois and Indiana

Expansion of oil production during 1937 within the Illinois Basin comprising the southern half of Illinois, western Indiana, and western Kentucky, has called for an entirely new appraisal of the oil reserves in this territory. Similarly, an entirely new appraisal must be made of the lifting equipment needs of this area over the immediate future. The area is so large and there are so many producing horizons, it is almost impractical to arrive at a conclusive estimate of these needs. However, most of the old and new areas indicate that oil production will come from relatively shallow depths. The more recently discovered "deep" production in the Clay and Noble pools has called for heavier pumping or lifting equipment but except for these fields, the majority of the equipment installed in the basin is relatively small.

Michigan

Practically all the wells in Michigan are being pumped. Most of the equipment used is comparatively old and major replacements will be



Modern pumping unit used in Haven, Kansas, field

ing Attention of Lifting Oil

Pumping operations usually go 24 hours a day

made in the coming year. While these are ample reserves of gas for the operation of these fields, fuel is an important factor in a majority of instances and increasing attention is being given to electric motors as prime movers.

Kansas

During 1938 Kansas will probably require more pumping equipment than any state with the exception of Texas. Throughout western Kansas it is common practice to equip the wells for mechanical production as quickly as completed. The units chosen are usually relatively large to secure a high potential. The depth of the Kansas wells varies from 1,800 feet in the Greenwood and eastern areas to around 4,400 feet in the western areas. Most of the oil producing formations are lime and this influences the choice of pumping equipment.

Since the extent of pumping equipment purchases in Kansas will be greatly influenced by drilling, it should be pointed out that in 1937 1867 oil wells were completed in that state. Many of these could be called "wildcats" and this fact is pointed out here, since the estimated needs for equipment in Kansas appearing on the insert referred to earlier does not include equipment to be used on wells outside the proven areas.

Eastern Fields

Modernization of a large portion of the pumping equipment used in the western Pennsylvania. New York, West Virginia, and eastern Ohio fields will take place in 1938 as producers in these areas must choose between this method to lower the cost of production or abandon many wells. Lightweight units equipped with independent gas engines or electric motors are receiving greater attention but the great majority of the replacements will be made with central powers.

Oklahoma

In Oklahoma one can see all types and sizes of lifting equipment. Oklahoma and California have served as proving grounds for many new units and this process of developing units by trial and error is still operative. Such a program is under way at the present time and on a large scale with respect to oil producing companies developing their own electric power. In the Fitts area several companies have installed field power-generating units and in northeastern Oklahoma another company is experimenting with power generation in connection with water-flooding. In other areas, public service companies are giving special attention to the growing demands for electric power and they are extending their facilities wherever economical. The result is that many Oklahoma wells are being equipped with electric motors.

The most important field generally referred to is the Oklahoma City field. This is made up of two distinct areas but is considered in the survey as parts of the same producing bed. The great bulk of the wells in the area are now being pumped by one method or another. At the present time only about 19 wells are flowing naturally, 674 are on the beam, 30 are being produced by gas-lift, 252 by centrifugal and hydraulic pumps and 31 wells are idle.

North Louisiana and Arkansas

Many old wells in the North Louisiana and Arkansas fields are producing such large quantities of water with the oil, the low oil recovery of many of these wells threatens the future operation of these fields. Low-cost lifting methods are being sought and a minimum of heavy pumping equipment is being bought. The outstanding exceptions to this are, of course, the Rodessa and Shuler fields where a continuation of drilling, declining bottom-hole pressures and favorable oil recovery conditions influence the installation of elaborate or heavy types of lifting equipment.

New Mexico

Due to the limited withdrawals of oil from the fields in New Mexico, relatively few wells in this state now require pumping equipment. The majority of wells in the state are now producing from lime formations, which after being acidized yield high potentials.

Gulf Coast

The new Louisiana Gulf Coast fields and the older Texas Gulf Coast fields in the Houston area present a major problem in lifting oil. All types and sizes of pumping equipment may be seen in these areas, the choice being dependent pretty largely on the availability of large quantities of gas. In a majority of fields ample gas is available. The same condition could be applied to the lower Gulf Coast area of Texas, more specifically referred to as the Corpus Christi area. Here, the Saxet fields in Nueces County appear now to be the largest potential users of lifting equipment in 1938 among all fields in the lower Gulf Coast area.

East Texas

Of the various important areas in Texas, that of East Texas probably presents the greatest need for pumping equipment in 1938. It is significant that as early as 1936 an average of 115 wells were being equipped for artificial lifting.

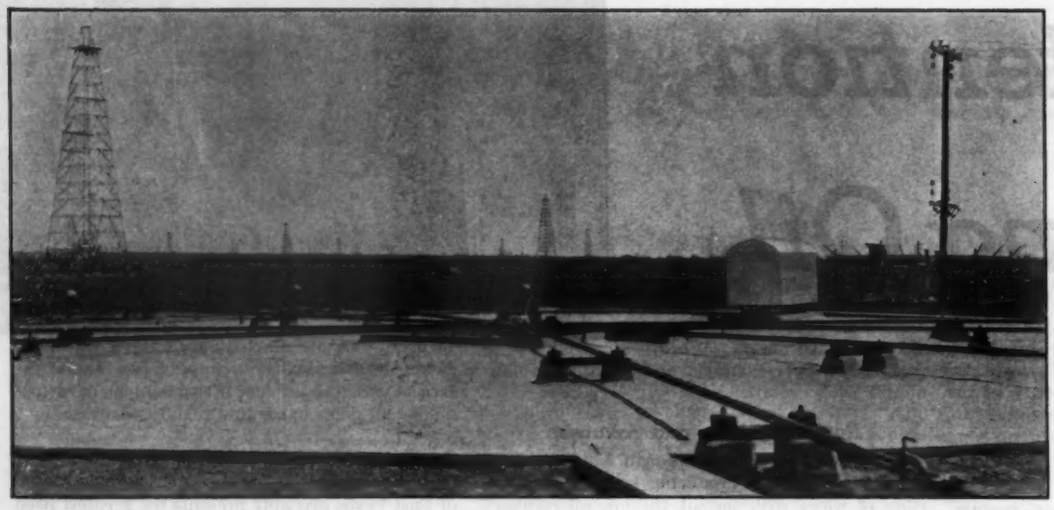
In 1937 the number of new pumping or gas lift installations per month averaged 165. It is estimated an average of 160 wells per month will require some sort of artificial lifting during the year 1938, or a total of about 1,900 wells.

Any consideration of probable lifting equipment needed in the East Texas field over the next 12-month period must take into consideration the large number of wells at which lifting equipment has been installed for several years but never used. This condition first became an important factor in the early part of 1933, when many operators viewed the comparatively rapid decline in average field pressures with alarm and hurriedly equipped a large number of wells in critical areas, many of which to date are still satisfactorily flowing their daily allowable. A review of stand-by pumping equipment for the last three years is as follows:

During 1935	3,080 wells equipped but not used
During 1936	2,350 wells equipped but not used
During 1937	1,950 wells equipped but not used
Total	7,380 wells

In other words, the surplus equipment is slowly being pressed into service. At the same time, how-

Interior of recently completed power-generating plant in Fitts pool of Oklahoma. Note method of ventilating building. Generator is shown in foreground and engine to the right



Electric-motor-driven, geared-central-power pumping a property in the East Texas field. Note the liberal use of concrete as a permanent walkway and foundations

ever, it is still the policy of some operators (both large and small) to set standby pumping equipment considerably ahead of their actual needs. This is particularly true in areas where inside locations are drilled on leases where central powers or backside cracking facilities are already in position. On such wells, when the concrete derrick floor is poured, the small foundations for pumping jacks are provided. In some instances the jacks are set at the time of completion, and painted as a preservative until needed for lifting service.

East Texas Survey

According to a survey as of January 1, 1938, out of the 6,550 wells either using artificial lifting equipment or equipped to pump, approximately 500 wells are on gas lift, 1,350 wells provided with standard pumping fronts, 2,000 wells on backside cranks, and 2,700 wells pumping off of 310 central powers. These percentages of total by types will probably vary some in the future, when it is especially expected that standard pumping fronts will show a decrease and backside cranking and gas-lift installations show an increase.

Looking to the future type of installations which will be made in East Texas, the governing factors of the past will probably remain a guide in the future. Most of the East Texas field installations have been predicated upon an estimate of future requirements rather than on the basis of present needs. It is the opinion of some that a good portion of the present pumping equipment will not be sufficiently heavy to care for ultimate loads, but others contend it is good economy to put in smaller units for a few years and change over to heavier and more permanent installations if needed during later life of the field when fluid to be lifted increases.

In former estimates of the rate at which East Texas wells will go to pumping, the decline in reservoir pressure has been used as the principal guide. Convincing indications are now being presented to show that other factors are probably more important in effecting this pumping rate, especially at this stage in the field's decline. The wide variation in structural and producing conditions over this vast 132,000-acre producing field does not permit any all-inclusive deductions to be made from average pressure figures obtained from 90 key wells of about 25,000 producing wells. Rather, consideration must be given locally to all the varying conditions throughout the field to reach any accurate idea on the field's performance over the next year or two. A recently compiled table gives the average bottom-hole pressure decline (as reflected by periodic surveys of key wells) at present as about .3 pound per 1,000,000 bbls. of oil recovered.

This factor would be more useful, however, if figures for each zone were available on drop in pressure per 1,000,000 bbls. of fluid recovered. These data are useful in considering the reservoir as a whole, but for the time being at least local considerations must be given to the various areas.

For 150 pages

of additional production facts and photographs, see special Production Section starting opposite page 88

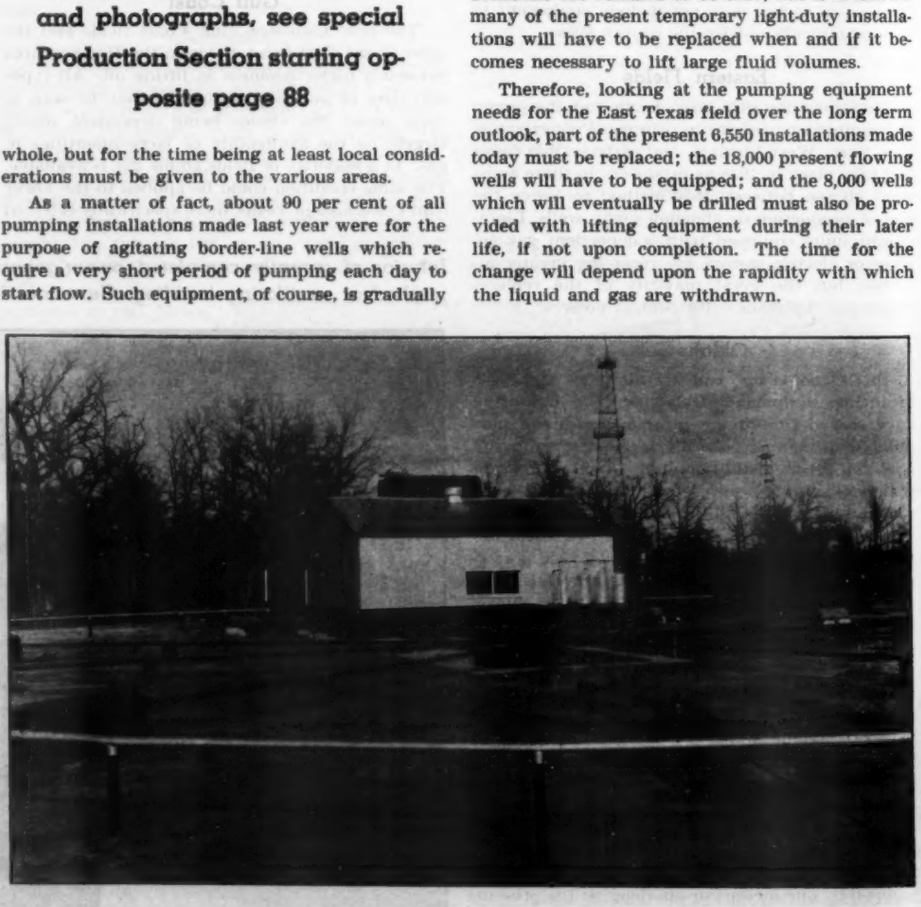
As a matter of fact, about 90 per cent of all pumping installations made last year were for the purpose of agitating border-line wells which require a very short period of pumping each day to start flow. Such equipment, of course, is gradually pressed into more constant service. This condition exists especially in the thin sand section along the eastern edge of the field and in the densely drilled areas.

The other principal condition contributing to new pumping equipment requirements is water encroachment along the western flank, which requires the lifting of water volumes as high as 80 to 90 per cent of total fluid in many wells. However, contrary to some prevailing thought, there still remain about 1,000 wells which might be termed extreme western edge wells along the 45-mile front which are still flowing their daily production without difficulty. Efficient manner of well completion, where the saturated sand was only "scratched," accounts for much of this continued natural flow. It is along this front that many of the standby units are installed, while the wells continue to produce by natural flow through their 2-inch low-pressure connections.

Rate of Completions

New well completions have averaged about 50 per week during the last two years, and at the present time there seems to be no immediate decline in drilling activity. Granting the field's 132,000 productive acres will eventually be drilled to an average density of one well to four acres (it is now less than one well to five acres), a total of 33,000 producing wells will eventually be pumped. Whether or not the equipment being installed today will prove adequate throughout the field's economic life remains to be seen, but it is known many of the present temporary light-duty installations will have to be replaced when and if it becomes necessary to lift large fluid volumes.

Therefore, looking at the pumping equipment needs for the East Texas field over the long term outlook, part of the present 6,550 installations made today must be replaced; the 18,000 present flowing wells will have to be equipped; and the 8,000 wells which will eventually be drilled must also be provided with lifting equipment during their later life, if not upon completion. The time for the change will depend upon the rapidity with which the liquid and gas are withdrawn.



Welded type guide posts, tubular power connections, oil bath safety throw-offs

Oklahoma Discovery May Open New Play

By DAL DALRYMPLE

Oklahoma wildcatters registered their second important strike of 1938 last week when an outpost opened an oil and gas producing area southeast of Waukomis, in southern Garfield County. The first major discovery of the year in Oklahoma resulted in opening of the Ramsey pool in Payne County, more than 40 miles southeast of the Garfield wildcat by airline.

The Harry Hollenbach and Nels Burton No. 1 Mattie Clark, NW cor. section 34-21-6w, is the wildcat that tapped a new producing sector and gave encouragement to prospectors seeking oil in northern and northwestern counties of Oklahoma. The well was rated good for 300 to 500 bbls. of oil naturally, with some 5,000,000 feet of gas, after it had cleaned itself two times before being shut in for tankage and connections.

Interest was focused on the Garfield wildcat when it found only a thin section of Mississippi lime below 7,025 feet. First Wilcox sand, found at 7,190 to 7,245 feet, was dry, but shows of oil and gas were found in a dolomitic sand penetrated from 7,245 to 7,319 feet. Operators drilled on, however, and second Wilcox sand at 7,319 to 7,337 feet, total depth, yielded nothing better than salt water and scums of oily mud.

Flows Through Perforations

A Schlumberger test indicated productive possibilities of the zone between the two Wilcox sands, so operators plugged back and perforated. Casing was punctured with 54 shots between 7,258 and 7,280 feet, oil rose about 500 feet in the hole in 15 minutes, gas broke through and it slopped over. When the crew pulled the perforating gun the well started cleaning itself and flowed for 10 minutes before subsiding and being shut in. It was opened again the following morning, February 16, and flowed for eight minutes, oil rising some 15 feet into the rig. It then was shut in for tankage. The oil tested 50 degrees gravity.

Additional tests have been delayed by severe weather and almost impassable roads. Operators may acidize through perforations before completing the well.

The producing horizon was identified as Marshall sand by some observers, and called Morrison sandy dolomite by others. Marshall sand takes its name from the Marshall pool, about 12 miles to the southeast in northwestern Logan County. The Marshall pool, opened nearly 12 years ago, has produced more than 13,500,000 bbls. of 40-gravity oil from various Pennsylvanian and Ordovician pay zones.

Interest Assigned

An interest in the Garfield discovery has been assigned by the operators to Anderson-Prichard Oil Corp., and that firm will complete and operate the well.

Considerable lease and royalty trading followed the first showings, but this phase of activity also was delayed by bad weather. Some royalty offsetting the well and elsewhere nearby changed hands but no sales of royalty under the well, reputedly priced at $500 an acre, had been reported. Offset royalty was quoted at $300 an acre, with prices ranging around $250 a half mile away and at $100 to $150 a mile away. Leaseholders around the well were reported receiving offers but retaining most of their acreage. Two or more major companies were said to be bidding for close-in acreage. Larger companies protected before the well was drilled in include Indian Territory Illuminating Oil Co., Phillips Petroleum Co., Magnolia Petroleum Co. and Turman Oil Co.

The Mattie Clark wildcat has had a varied history. The original well was drilled in C NW NW section 34-21-6w, by J. Harmon Lewis and associates on a farm-out deal from Indian Territory Illuminating Oil Co. about three years ago. The hole was lost at 6,518 feet with tools stuck on bottom and it was abandoned. A high was indicated when Lewis had the structure seismographed and drilling proved the high, but for two years after initial attempt the territory was neglected. The acreage then was reblocked and Lewis and associates made a farm-out deal with Hollenbach and associates. They assigned leases and royalties to Hollenbach and others and aided in financing the new venture. The I. T. I. O., Magnolia, Phillips and Turman companies also contributed to the test, and several weeks ago the Anderson-Prichard company became a participant by agreeing to provide casing and tanks.

Hollenbach - Burton No. 1 Clark, Garfield County wildcat, flowing high-gravity oil

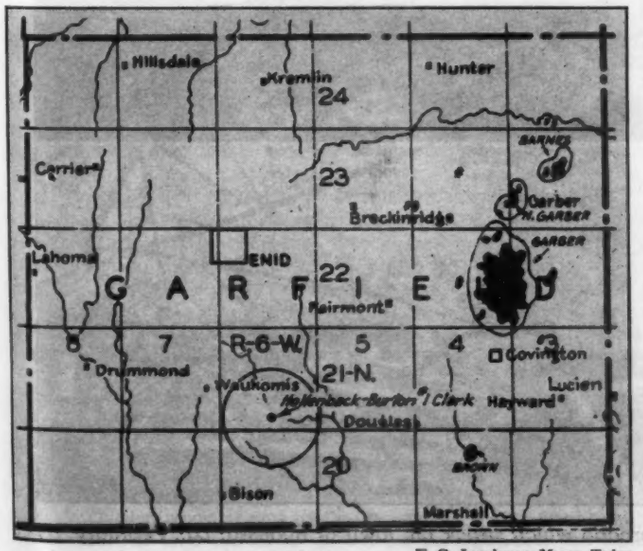
If a new oil field develops from the showing of the Mattie Clark, it will be the first pool of any consequence found in Garfield County since the Garber-Covington deep sand was uncovered in 1925. It also will be the first pool opened west of the trend extending northward from Crescent through Lovell, Marshall, Brown and Garber pools.

Key to Northwest

Importance of this Garfield County strike rests not only in its designation as a pool opener, but in the effect it will have on further exploration in a vast nonproductive area. Geologists see the wildcat as a key to northwestern and north-central Oklahoma development.

Located about 10 miles southeast of Enid, it represents the farthest northwest advance of production in Oklahoma. No oil as yet has been found in that extensive district between the Garfield strike and production in the Medicine Lodge and Whelan areas of Barber County, Kansas.

Previous attempts to find oil in western Garfield and Grant counties, and in Major, Alfalfa, Woods and other northwestern Oklahoma counties have been unsuccessful. These outlying sectors probably will come in for more consideration and exploration as a result of the Garfield strike and the new Barber County development. Many lease blocks have been taken in the northwestern counties. If the Garfield wildcat should prove a pool of any size, more wildcat tests undoubtedly will be drilled this year or next in this rank wildcat country.



E. C. Jacobson, Maps, Tulsa

Farthest northwest Oklahoma pool opened in Garfield County, indicated by arrow

SPARKS FROM THE NEWS

SUGGESTION

Commodity prices should be advanced, says President Roosevelt, "including finished products which are produced and sold under highly competitive conditions." This covers the position of the small refiner completely.

APATHY

Refiners unable to move gasoline already on their hands can't work up much interest in discussions of substitutes to be used when the refined product gives out.

LIMITATIONS

Three outpost tests with discouraging showings indicate again there are limitations to everything—even the large K.M.A. field in North Texas.

NEW SUPPLY

The first crude from the Temblador field in southeastern Venezuela reached the coast last week via pipe line and shallow-draft tanker. Eastern Venezuela promises to become a major oil supply in the near future.

IN STRIDE

Latest reports show the world's deepest well in California is drilling away at 13,652 feet. Instead of slowing up it seems to be hitting its stride.

THREE-WAY CONSERVATION

Drillers constantly are finding new reserves, and refiners are manufacturing more and better products from the crude. Of equal importance are the pumpers who are bringing to the surface crude formerly left in the ground.

ANNUAL STATEMENT ECHO

A major oil company's 1937 taxes totaling $35,484,047 were 28 per cent of its assets and 35 per cent greater than its total salary and wage payments.

IN THIRD PLACE

The Wilmington field last week moved into third place, with a production of more than 100,000 barrels daily. Only East Texas and Oklahoma City exceed it.

SO WHAT?

Last year the excuse for making too much gasoline was that it couldn't be helped. Heating oil was demanded, and gasoline was an unavoidable by-product. This year refiners have too much heating oil, but gasoline stocks are mounting just the same.

TEMPORARY?

The fuel-oil tax apparently is buried again so far as this session of congress is concerned. Its sponsors, however, succeeded in obtaining more consideration for their proposal than ever before.

BRIEF EXPLANATION

"OIPO" is the cause of the industry's present ills according to word from the A.I.M.E. meeting at New York. Translated it means "oversupply of immediately producible oil."

JOURNALS SURVIVE TORNADO

Tornado which struck the town of Rodessa, La., February 17, resulted in heavy damage to field properties and supply houses. Upper view shows several copies of The Oil and Gas Journal undamaged in office that was demolished

Committee Rejects Fuel Oil Tax Bill

By HENRY D. RALPH

WASHINGTON, D. C., Feb. 21.—Unofficial but authoritative reports indicate the house ways and means committee will not include the Boland proposal for a tax of 1 cent per gallon on fuel oil in the revenue revision bill now being put into final form. Without committee endorsement there is little chance the tax could be inserted as an amendment on the floor of the house.

Committee members in charge of drafting the bill are adhering to a rigid policy of excluding all subjects not included in the draft prepared by the Vinson subcommittee and on which hearings were held. When the bill is taken up on the floor it undoubtedly will be under a special rule limiting debate and making it exceedingly difficult to insert any amendment without the approval of the ways and means committee, a policy usually followed in considering tax measures. Since members of congress from fuel oil producing and consuming states far outnumber those from coal-producing districts, it appears unlikely the fuel oil tax can muster a majority, although its sponsors undoubtedly will carry out their intention to seek a vote on the amendment.

The Interior Department has not yet submitted to President Roosevelt the data on petroleum reserves which the president requested in connection with the Boland proposal, and while officials of the bureau naturally refuse to discuss the nature of the material being prepared for the president, many of them are obviously unsympathetic to the fuel oil tax proposal.

Antitrust Enforcement

A serious blow to increased antitrust activity was delivered by the house in passing the appropriation bill for the Department of Justice with only half the increase in the appropriation for the antitrust division recommended by the Bureau of the Budget. The total carried in the bill for the antitrust division is $580,060, an increase of approximately $132,000. The budget bureau recommended an appropriation of $692,250, although the department had asked for $1,028,540. In its report the appropriations committee stated:

"In as much as the policy of the government in regard to antitrust matters is as yet not clearly defined, it is believed by the committee that this increase will be adequate."

Unless this appropriation is increased by the senate, it will mean the department will not be able to institute many new antitrust cases. Robert H. Jackson, assistant attorney general in charge of the antitrust division, told the appropriations committee it takes approximately $100,000 a year to prosecute an antitrust case, and that the funds recommended by the budget will permit the department to bring only two or three of the 12 or 15 cases the department would like to bring next year. Since the antitrust division also handles a great many other types of court cases, such as appeals under the Guffey coal act, farm act, and other laws, it is possible the entire increase in the appropriation will be needed for work of this character.

Under questioning from members of the appropriations committee, Mr. Jackson admitted there is confusion in the minds of Department of Justice officials as to the exact meaning of the antitrust laws and clarification and revision of the laws is imperative. He said he undertook the task of heading the antitrust division only with the understanding that the administration would make an effort to revise the antitrust laws. He also stressed the need for employing economists in the antitrust division, whereas at present the law prohibits the employing of any experts except lawyers.

The question of patent monopolies was discussed during the hearings on the antitrust appropriation, and under questioning Mr. Jackson declared:

"The motor companies have a virtual monopoly. Some industries have pooled their patents in the sense in which the motor companies have, in a certain way, which is substantially this. The company that brings out the patent has it for the first year. They get the leadership in it. But in the second year, I believe, or the third year, perhaps, it is open to all on a royalty basis. Some other companies, however, pool their patents among themselves, but they will not let any outsider have a license and make, in effect, free competition among a group, but without any outsiders. I have felt, myself, that probably the most reasonable way of handling the patent monopoly by law, is the way the motor companies handle it voluntarily. I think they pointed the way to the solution of the patent problem; that the owner of a patent should be compensated if somebody uses his idea, should be paid, but he should not be able to suppress an invention by getting it under patent. This patent thing needs looking into."

Madison Case

The senate judiciary committee has recommended confirmation of Mr. Jackson as solicitor general, but only after hearings in which several members of the committee severely criticized Mr. Jackson's antitrust policies, particularly the department's conduct of the Madison oil case and the automobile finance case. The assistant attorney general was particularly questioned about his policy in attempting to pick favorable judges for the trial of antitrust cases. He defended the practice and asserted he would pick a friendly court whenever he could. He also submitted a lengthy memorandum explaining the history of the automobile finance case in which Federal Judge Geiger of Milwaukee dismissed a grand jury after learning that the Department of Justice was negotiating with the defendants for a consent decree, and he declared that while the government has the legal right to decide whether to bring a civil or a criminal suit in an antitrust case, grand jury proceedings are

not used in an effort to coerce defendants into agreeing to a consent decree. The senate is expected to confirm Mr. Jackson as solicitor general, and there is no indication who will succeed him as head of the antitrust division.

Commerce Department Appropriations

The appropriation bill for the Department of Commerce, passed by the house, restores to the Bureau of Foreign and Domestic Commerce a cut of 10 per cent in its fund which had been recommended by the budget bureau, so that the appropriation for the coming year will be practically the same. The appropriations committee declared there is no justification for a horizontal reduction in the appropriations for an agency which serves business at a time when the government is attempting to restore business activity. In addition, the committee included $10,000 above the current appropriation for aid to export industries, with the explanation that approximately $6,000 of this sum can be used to decided advantage in strengthening the statistical service rendered the petroleum industry by the petroleum division of this bureau. At present the petroleum division has an appropriation of about $4,500, and the increase will raise the division to a status comparable with other commodity sections of the bureau and permit employment of an additional business specialist and a statistical clerk, so that more statistics on imports and exports of petroleum products may be issued and the division's reports may be published more promptly.

Tidal Oil Lands

Much interest has developed in the hearing February 23 on the Nye resolution directing the attorney general to bring suits to establish the title of the federal government to all oil-bearing lands covered by coastal and other navigable waters. This resolution passed the senate last year with little public discussion and has been lying buried in the house judiciary committee. The fact that Chairman Sumners of this committee has ordered hearings on the bill strongly suggests that the administration is bringing pressure for its passage. The resolution affects chiefly oil wells on the California and Texas coasts, and it is reported California state officials have withdrawn their former opposition to it. The navy department is understood to be interested in the measure as a means of increasing the reserves of petroleum controlled by the government for national defense. The original proposal of Senator Nye was a bill to declare all oil deposits under tidal and navigable waters to be federal property and establish them as a naval petroleum reserve, but this was abandoned in favor of the resolution directing the attorney general to bring court action to obtain title.

Crude Price Investigation

The Department of Justice apparently is more interested in complaints about the price of crude petroleum in East Texas than officials were willing to admit when it was first revealed that these complaints were being investigated. Complaints of independent refiners in East Texas and Oklahoma that the price of crude in that region is being held up out of line with the price of gasoline, causing many of them to close down, have been pouring into the Department of Justice and members of congress. Department officials at first stated these complaints were being studied as a routine matter and no extensive investigation was likely. Later it was revealed the complaints had been referred to the Dallas office of the Federal Bureau of Investigation and that the evidence suggested interstate commerce was affected by what appeared to be an artificial manipulation of the crude oil price. Since some of the complaints have laid the difficulties of the independent refiners to the termination of the gasoline buying pool as a result of the Madison trial, the department can be expected to look for antitrust violations in connection with crude prices rather than let the impression remain that its Madison case is the root of the trouble.

Alcohol in Gasoline

On top of congressional enactment of the most comprehensive and far-reaching farm bill ever proposed, the old alcohol-gasoline brand of farm relief has cropped up again in the form of two new bills. One of these, introduced jointly by Senator Gillette and Representative Harrington of Iowa, would simply exempt from the present federal gasoline tax of 1 cent per gallon all motor fuel containing at least 10 per cent of alcohol produced from annual agricultural crops grown in the United States. The other, introduced by Representative Knutson of Minnesota, would make it a federal offense, punishable by a fine of $1,000 or imprisonment for a year, to sell any motor fuel not containing at least 10 per cent of alcohol produced from annual domestic farm crops. In addition to this drastic penalty, the bill would impose a tax of 10 cents per gallon on any unblended motor fuel sold.

A.P.I. Makes Adjustment in Its Reserve Estimate

In a report released by the American Petroleum Institute it is estimated the petroleum reserves in this country had reached a total of 15,507,268,000 bbls. on January 1, 1938. This is an increase over the reserve figures prepared by the same committee and released January 1, 1937, by 2,443,868,000 bbls., and more than 3,330,268,000 bbls. greater than its January 1, 1935, estimate.

The total reserves as estimated by the A.P.I. committee as of January 1, 1937, were 13,063,400,000 bbls. as compared with its revised estimate of 13,632,000,000 bbls., January 1, 1935. Using the January 1, 1937, total as a base, the committee added 2,792,790,000 bbls. in making a revision in reserves in fields included in the January 1, 1937, estimate. In addition to this revision, the committee reported a discovery of only 928,742,000 bbls. of new oil during 1937, whereas The Oil and Gas Journal reports in detail the discovery of 1,848,568,500 bbls. of new oil during the 12 months prior to January 1, 1938.

The A.P.I. committee states the estimates of 1937 have been revised because of data furnished by later development in the fields covered by the last-year report and the increased ability of the industry to recover more of the oil from the underground reservoirs. This increase represents 21.25 per cent over the 1937 estimate. It indicates that by making this revision the industry has available 119 per cent more oil than was produced during 1937. The A.P.I. reports 1,277,664,000 bbls. of oil produced during the year; the revision represents 2,792,790,000 bbls., and the increase is therefore 1,515,126,000 bbls. In addition to that increase, the A.P.I. reports the finding of 928,742,000 bbls. of oil in new fields.

The committee was composed of J. Edgar Pew, chairman, Sun Oil Co., Philadelphia, Pa.; R. F. Baker, Texas Co., New York; L. T. Barrow, Humble Oil & Refining Co., Houston, Tex.; Frank R. Clark, Ohio Oil Co., Tulsa; G. Clark Geister, Standard Oil Co. of California, San Francisco, Calif.; W. B. Heroy, Consolidated Oil Corp., New York; F. H. Lahee, Sun Oil Co., Dallas, Tex.; J. M. Sands, Phillips Petroleum Co., Bartlesville, Okla.; Fred E. Wood, Standard Oil Co. (Indiana), Chicago.

The detailed report follows:

ESTIMATED PROVEN PETROLEUM RESERVES IN THE UNITED STATES
(In thousands of barrels)

	Reserves as of Jan. 1, 1937 (1)	Provisions in reserves in fields included in Column 1 (2)	New reserves discovered during 1937 (3)	Total (Columns 1, 2 and 3) (4)	Production during 1937 (5)	Reserves as of Jan. 1, 1938 (6)
California	2,955,726	295,000	51,000	3,301,726	238,584	3,063,142
Rocky Mountain States:						
Wyoming	238,980	20,625	25,050	284,655	18,733	265,922
Montana	91,810	23,400	.....	115,210	5,832	109,378
Colorado	15,222	3,400	2,000	20,622	1,497	19,125
New Mexico (N.W.)	5,793	.....	.....	5,793	379	5,414
Total	351,805	47,425	27,050	426,280	26,441	399,839
Central and Southern States:						
New Mexico (S.E.)	464,889	110,343	4,320	579,552	38,379	541,173
Texas	6,421,800	1,921,314	416,000	8,759,114	511,186	8,247,928
Oklahoma	1,141,000	242,464	57,228	1,440,692	228,440	1,212,252
Kansas	568,271	21,729	82,000	672,000	70,683	601,317
Arkansas	84,185	3,308	116,401	203,894	11,793	192,101
Louisiana	524,052	132,792	147,243	804,087	90,653	713,434
Total	9,204,197	2,431,950	823,192	12,459,339	951,134	11,508,205
Eastern States:						
Illinois	28,210	.....	20,000	48,210	7,326	40,884
Indiana	3,441	.....	.....	3,441	819	2,622
Kentucky	38,846	.....	5,000	43,846	5,480	38,366
Michigan	44,199	18,415	2,500	65,114	15,933	49,181
New York	66,000	.....	.....	66,000	5,465	60,535
Ohio	32,000	.....	.....	32,000	3,544	28,456
Pennsylvania	307,000	.....	.....	307,000	19,114	287,886
West Virginia	31,976	.....	.....	31,976	3,824	28,152
Total	551,672	18,415	27,500	597,587	61,505	536,082
Total United States	13,063,400	2,792,790	928,742	16,784,932	1,277,664	15,507,268

Column 1—From report of A.P.I. Committee on Petroleum Reserves, published in April, 1937, A.P.I. Quarterly, Vol. 7, No. 2.

Column 2—Developments during 1937, giving more complete and better information, indicate that these amounts should be added to the earlier estimates of the reserves in the known fields as of January 1, 1937.

Column 5—U. S. Bureau of Mines' production figures for first 11 months, with December production estimated by A.P.I.

Petroleum Engineers Talk Practices and Problems

By H. STANLEY NORMAN

NEW YORK, Feb. 21.—Exploration and exploitation practices within the oil industry during 1937 were subjected to thorough review at last week's annual meeting of the A.I.M.E. in New York. Domestic and foreign production symposiums occupied one full day of the petroleum division program; another was devoted to a general session at which technical problems of well pressures, well-spacing and oil consumption were discussed, followed in the afternoon by a joint consideration of educational adequacy in the field of geophysics.

The economic session Thursday morning and the petroleum division annual dinner Thursday night rounded out the program. Every oil-producing state in this country was reviewed as to outstanding developments of 1937. Production trends formed the basis for most of the papers, with almost equal importance attached to the new discoveries and prospects for 1938.

G. B. CORLESS

G. B. Corless of Houston, Tex., Humble Oil & Refining Co., is chairman of the A.I.M.E. petroleum division for the current term succeeding M. Albertson, Shell Oil Corp., San Francisco.

Henry L. Doherty, president of Cities Service Co., this year's recipient of the Anthony L. Lucas medal, who has been in ill health for several months, attended the general institute banquet to receive the medal in a wheel chair. The presentation was made by John R. Suman of Houston, director of Humble Oil & Refining Co. Mr. Doherty was selected for the 1937 award because of his contribution to conservation of petroleum. He was described as the first to recognize the value of gas in solution and as an outstanding contributor to modern conservation policy.

From a strictly technical standpoint, the petroleum division program featured the study of "Abnormal Pressures and Pressure Variations With Depth of Petroleum Reserves," by G. E. Cannon and R. C. Craze of Houston, Humble Oil & Refining Co. engineers. They discussed results of a study of the reservoir pressures in the Gulf Coast area of Texas and Louisiana, showing a general relation of the reservoir pressure to its subsea depth as well as cases where abnormal pressures have been encountered.

The abnormal pressure studies were said to be of particular importance in mud-control work. They said an examination of data shows why it is necessary to use muds having a relatively high density in many of the deeper wells drilled in the Gulf Coast area.

Pressures were measured by several methods, including estimates of the original pressures from subsequent pressure behavior of fields; measurement of shut-in pressure soon after completion of the first producing well; measurement in connection with drill-stem tests and estimates from the maximum hydrostatic head of mud which failed to prevent flow from the high-pressure formations into the hole.

Usually, the authors said, a mud density of at least 9.8 pounds per gallon (51.5 pounds) per square inch per 100 feet is necessary for ordinary drilling in new areas at depths not greater than minus 7,000 feet. This allows, they said, a reasonable factor of safety to take care of not only the high pressures expected in the upper part of the gas sands but also of a reasonable reduction in pressure which occurs when drill pipe is withdrawn.

Abnormal pressures may be encountered over a broad territory in the Gulf Coast extending from Bee County, Texas, to Terrebonne Parish, Louisiana, a distance of 500 miles, and inland from the coast line as much as 50 miles. The authors said abnormal pressures had been observed in Miocene, Middle Oligocene, Frio, Vicksburg and upper Saline Bayou to show that no geographic or geological correlation is permissible in anticipating abnormal pressures.

Several theories were outlined as to the causes of abnormal pressure. A factual statement was that it appears probable the sands containing fluid must be of limited extent and in poor communication with sands that are continuous to outcrop. Other evidence indicates that sands from which blowouts occur are of low permeability. Still another theory exists that earth movement or erosion has brought the horizons substantially nearer the surface while retaining the original pressure on the fluids within the sand.

"The theory that seems to explain the facts most satisfactorily," said Mr. Cannon and Mr. Craze, "is that at great depths the earth strata are unable to support completely the weight of the overburden, and undergo sufficient compaction, with a corresponding increase in pressure on the fluid in sands to permit the fluid pressure and the stress in the earth structure to balance the weight of the overburden. It is interesting to speculate upon the possibility of the upper strata acting as an arch supported from beneath almost entirely by fluid pressure so that any variation in pressure would cause the center of the arch to move up or down. Observations made while pumping mud or dirty water into certain sands indicate the possibility of this occurring."

HENRY L. DOHERTY

Some of the practical results of a planned development program were explained in a paper describing the Tempino field in Sumatra, Netherlands East Indies, about 175 miles from Palembang.

The field was discovered in 1929 by Bataafasche Petroleum Maatschippij, Royal Dutch-Shell, on behalf of Nederlandsch Indische Aardolie Maatschappij, the sole concessionaire. Only the two most northern of four separate highs on the anticlinal structure are under development. Main structural features found in the development consist of two transversal faults which divide the field and eight distinct sand horizons separated by impermeable shale bodies. The first oil well in the Tempino field was completed in 1931 for an initial of 700 bbls.

(Continued on Page 54)

East Texas A. P. I. Division of Production Elects Officers

KILGORE, Tex.—At the meeting of the East Texas chapter of the American Petroleum Institute, Division of Production, held in the High School auditorium in Kilgore, on February 15, the following officers were elected to serve for 1938:

Chairman, Byron Meredith, Sinclair Prairie Oil Co., Troup; vice chairmen, R. M. Bradbury, Houston Oil Co., (Laird Hill), M. W. McVey (Kilgore), M. L. Brown, Sun Oil Co. (Dallas); secretary-treasurer, W. S. Morris, East Texas Engineering Association (Kilgóre); assistant secretary-treasurer, E. B. Miller, Jr., Tide Water Associated Oil Co. (Kilgore).

The following advisory committee was chosen: R. D. Risser (chairman), Shell Petroleum Corp.; R. C. Barbour, Humble Oil & Refining Co.; C. D. Hubbard, Weaver-Crim Corp.; R. W. Sole, Arkansas Fuel Oil Co.; C. E. Wharton, Hanlon-Buchanan; J. E. Springer, Tide Water Associated Oil Co.; M. C. Sells, Sells Petroleum Corp.; W. J. Christian, Railroad Commission of Texas; J. W. Steele, Federal Tender Board; L. H. Mack, General American Oil Co.; A. Lawrence, Cities Service Oil Co.; A. M. Martini, Bell and General Pipe Line; E. G. Bateman, Bateman Drilling Co.; Ira L. Page, Stanolind Oil & Gas Co.

Program committee: W. D. Herring, Kilgore; R. M. Bass, Sinclair Prairie Oil Co.; G. R. Kennedy, Magnolia Petroleum Co.; R. R. Kyner, Gas Lift Corp.

Membership committee: J. P. Straight, Cities Service Oil Co.; J. J. Jenkins, drilling contractor; J. C. Randolph, National Supply Co.

Following the election of officers, two interesting papers were presented to an audience of 368 oil men. The first was by Ben M. Givens, superintendent for Sun Oil Co. at Arp, Tex., on "The Treatment of Oil Field Emulsions in East Texas." The next was by F. G. Beckman, Beckman, Inc., Muskogee, Okla., on "The Completion of Oil Wells in the East Texas Field by the Reverse Circulation Method."

The Safety Team of Empire Pipe Line Co. at Gladewater, under the direction of P. O. Teters, gave a demonstration on first aid to the injured. This work was highly commended.

The entertainment consisted of selections by the male quartet of Magnolia Petroleum Co. at Kilgore, directed by L. F. Taylor, followed by Frank S. Carothers, of Norvel-Wilder Supply Co., Houston, who gave a humorous monologue.

BYRON MEREDITH

Kansas Oil Men's Association Opposes Proposed Fuel Oil Tax

WICHITA, Kans.—The Kansas Oil Men's Association, meeting here, adopted resolutions opposing the proposed tax on fuel oil now before congress and asking repeal of the federal tax on gasoline and lubricating oil. Officers were reelected as follows: Ed M. Taylor, Kinsley, president; C. A. Elmborg, Eldorado, treasurer; C. E. Holmes, Wichita, executive secretary. Directors: A. F. Geyere, Waterville; S. C. Tolbert, Concordia; R. L. Kent, Salina; C. S. Bishop, Dodge City; Dean Kimmel, Hiawatha; Kenneth Crumly, Colby; A. D. Griffin, Leavenworth; L. B. Noher, Arkansas City; Nick Simoncic, Pittsburg, and E. J. Kirschner, Topeka.

Judge Walter E. Brown, of Kansas City, Mo., counsel for Sinclair Refining Co., and chairman of the Kansas petroleum industries committee, discussed legislation affecting oil jobbers and marketers.

Pennsylvania oil fields are still a vigorous factor in the business, in the opinion of Joseph E. Moorhead, executive secretary of the Pennsylvania Grade Crude Oil Association, who was in Wichita for the meeting.

"There are some oil wells in Pennsylvania," he said, "which are so low in daily output that a good dairy cow could exceed them in liquid volume of production, but the owners of these wells regard them as a genuine source of present and potential profit."

Gasoline Investigation Under Way at Erie, Pa.

ERIE, Pa.—Earl Tisdale, secretary of Erie County Petroleum Dealers Association, says a two-way state investigation will be made into the gasoline situation in Erie which has resulted in prices ranging from 14 to 19 cents a gallon. Tisdale said Arthur Miles of the state department of revenue, is investigating what he termed "illegal" advertising of prices throughout the city while a second check was due by the state oil investigating committee to determine if some stations are selling below cost. Tisdale asserted 30 filling station attendants had lost jobs because of the price war.

Bureau Estimates March Crude Demand 5 Per Cent Over Year Ago

WASHINGTON, D. C., Feb. 21.—The Bureau of Mines estimates a daily average supply of 3,391,600 bbls. needed to meet domestic crude oil demand in March. 46,600 bbls. less than for February and 51,100 less than a year ago, but 5 per cent higher than actual demand in March, 1937.

The bureau estimated domestic motor fuel demand at 40,680,000 bbls. for March, or about one-fourth of 1 per cent higher than in March, 1937.

The bureau estimated motor fuel exports for March would be 3,600,000 bbls.

Stocks of finished and unfinished gasoline amounted to 76,900,000 bbls. on December 31. These stocks increased about 8,000,000 bbls. during January.

Assuming the increase in February is held to 6,200,000 bbls., stocks on February 28 will be just over 91,000,000 bbls.

Dr. G. G. Brown Files Report On Turner Valley Crude Oil

OTTAWA, Ontario, Feb. 19.—A report by Dr. George Brown, professor of petroleum engineering at Michigan State University, submitted to the Federal Tariff Commission here, estimates that about 3,000 bbls. a day of Turner Valley crude could be used by Imperial Oil, Ltd., at its Sarnia refinery. The quoted differential of 22 cents a barrel in favor of Turner Valley over Mid-Continent crude was given as substantially correct, though by-products were less valuable, more ethyl was necessary for treatment and expenses was raised by unloading from tankcars at Sarnia. Offsetting these items was the greater quantity of gasoline produced. Cost of unloading was placed at 3 cents a barrel, and total value of Turner Valley crude at $2.0076 per barrel f.o.b. tankcars at Sarnia, compared with laid down costs from United States fields by pipe line of $1.947 per barrel. Turner Valley crude contains more sulfur, and the extra cost of ethyl is estimated at 9.52 cents per barrel.

Texas Supreme Court Grants Reclamation Case Review

AUSTIN, Tex., Feb. 21.—The state supreme court has granted the state's request for a review of an appellate court judgment which would permit Beaver Reclamation Oil Co. to move 36,462 bbls. of oil.

Deepest Mississippi Test Abandoned at 8,673 Feet

JACKSON, Miss.—Sun Oil Co. and associates No. 4 Kate Talley, in section 33-4n-15w, Lamar County, Mississippi, has been abandoned at total depth of 8,673 feet in salt, topped at 8,650 feet. It was the fifth—and probably the last—test on this salt dome discovered by these companies in section 28-4n-15w, around 2,500 feet subsea depth. Joe Modisett, Shreveport contractor, drilled all five tests. The last hole broke the previous depth record of 8,002 feet in Mississippi.

Phillips Petroleum Co. No. 1 J. J. Newman Lumber Co., in section 21-2n-10w, Perry County, was drilling below 6,940 feet and Black River Oil Co. (William C. Durant and others) No. 1 Federal Land Bank, in section 11-15n-5e, Hinds County, below 7,100 feet.

Mexican Government Deal On Oil Equipment Buying

The Mexican government announces it has signed a contract with James Stewart & Co. of New York by which the company is to act as the government's purchasing agent for machinery for railroad development and petroleum machinery, and materials for other undertakings.

Officials of the firm are reported to have approached informally officials of the Export-Import Bank with a suggestion that a credit of up to $30,000,000 be extended to the Mexican government for the purchase of materials in this country over a period of five years.

Shell Reduces Daily Runs To Stills by 10 Per Cent

ST. LOUIS, Mo.—A reduction of approximately 10 per cent in the daily average crude oil consumption at company refineries has been announced by the Shell Petroleum Corp. Shell refineries are located at Houston, Texas; Norco, La.; Arkansas City, Kans.; Wood River, Ill., and East Chicago, Ind. All plants have been operating at near-capacity levels except the Arkansas City refinery.

British Firm Is Reported in Oil Deal With Mexico

Harrison, Ltd., of London, is reported to have signed a contract with the Mexican petroleum administration for purchase of approximately 1,000,000 bbls. of government oil. D. A. Thomas of Vancouver was reported to have closed the deal. Belief was expressed that Corry Brothers, London brokers, are associated with Harrison, Ltd. The agreement, it is said, included extension of credits against the future delivery of oil.

the OIL AND GAS JOURNAL

PRODUCING REFINING NATURAL GASOLINE PIPE LINE

Published weekly by The Petroleum Publishing Company at Tulsa, Oklahoma

Why Not?

The federal administration with a business recession of several months duration on its hands is trying to find some new method of getting business started upward.

As usual, it seems to be more concerned with involved remedies the efficacy of which, based on previous experiments, is at least questionable. There is a more direct method the value of which cannot be doubted. It involves the removal of these so called "luxury" and "emergency" taxes directed at the closely allied automobile and oil businesses.

One of the chief reasons why business is now in reverse is because people are not buying new automobiles on the scale they were purchasing them during the past three years. This has thrown thousands out of employment directly and tens of thousands more, indirectly, with a resulting pall over the entire business world which will continue until the causes are removed.

The automobile industry is the largest customer of many other major industries. It absorbs directly 18 per cent of all the steel produced in the country, 73 per cent of the plate glass, 36 per cent of the lead, 28 per cent of the nickel, and substantial percentages of the hardwood lumber, tin, zinc, leather and cotton produced in the United States, as well as a large proportion of many other raw materials and finished products.

It provided directly 3,725,000 carloads of freight for American railroads last year and, indirectly, in addition a very large share of the rail movement was due to raw materials and products used by the automotive industry.

The principal reason why the automobile business is threatened with a decline of from 35 to 50 per cent under the 1937 figure is the higher prices which manufacturers have been forced to make effective due in large part to higher taxes.

The car buyer himself finds he has to pay a 3 per cent federal tax on the car, a 2¼ per cent tax on tires and a 2 per cent tax on parts and accessories. In addition motorists this year will pay approximately a quarter billion dollars in federal taxes on gasoline and lubricating oil, on top of the billion they will pay in state and municipal gasoline taxes. Special taxes on motorists increased in 10 years five times as rapidly as general taxes.

These two complementary industries, the automotive and the petroleum industries, do not seek and have not sought special favors from the government. They have not asked for loans at low rates of interest or other types of subsidies nor do they need official propaganda to sell their products.

On the contrary, these allied industries demonstrated during the 1929 depression that they can stand on their own feet because they have something people want to buy and give the public constantly better value.

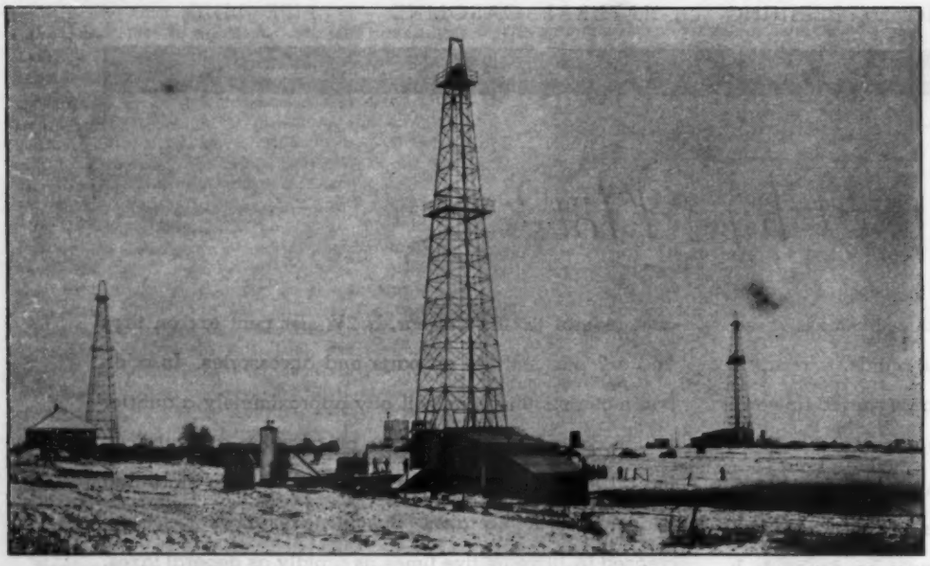
Operating on this principle they have built up these two great industries whose customers contributed over a billion and a half dollars in tax revenue last year. But this slackening in buying indicates there is a limit to tax exactions.

There is a hint here for the administration. Nothing it could do would start business going so quickly as removal of the tax burdens which are handicapping the automobile industry.

Look at the countries where the motor vehicle and motor fuel are taxed as luxuries and note the result. The lagging progress of peoples, industrially and individually reflects that policy. Are we to be headed that way?

The automobile and petroleum industries led the country to recovery. They can do so again if the government will remove the shackles. Federal action would set the example for equally needed easing of the tax burdens by the states and local governments.

Second Producer in Ramsey Pool Is Rated as 15,000-Bbl. Well



Mid-Continent Petroleum Corp. and others No. 1 Brandon, SE SE NE section 13-18-1e, center of picture, was washed in Monday afternoon, February 21, to make the second producer in the Ramsey pool, Payne County, Oklahoma. The discovery well, same operators' No. 1 Ramsey, rated as a 13,000-bbl. producer at left, and their No. 1 Wetzel, now nearing rich pay sand, at right, are shown.

No. 1 Brandon flowed 500 bbls. of oil the first hour after washing in, and 497, 463 and 484 bbls., respectively, in the next three hours before being shut in. On that showing, operators estimated the well at 15,000 bbls. daily. Gas was estimated at 6,000,000 feet daily. It had Wilcox sand at 4,764-91 feet, total depth. This well is a west offset to the discovery producer.

Operators' No. 1 Columbia Wetzel, NW NW SW section 18-18-2e, south offset to the discovery, was due for immediate completion and was expected to be as large as the two first wells. It topped Wilcox sand at 4,780 feet, at the same subsea level as in the discovery well, considering difference in surface elevation. Cores were well saturated. No. 1 Carl Wetzel, southwest offset to the discovery, was due to drill plug and core ahead for Wilcox pay. It had Simpson Dense at 4,725-30 feet.

THE MARKETS*

CRUDE OIL: *Prices generally steady including tanker quotations at the Gulf for export and coastwise movement. Refinery shutdowns in East Texas are tending to end premium-paying with predictions that posted schedules at wells will be reduced to levels of similar grade oil in other areas.*

REFINERY: *Tankcar quotations on third-grade gasoline in East Texas slightly higher with firmness in gasoline quotations reported in other areas. Better demand for natural gasoline in the Mid-Continent. Most grades of fuel oil freely offered with price concessions reported at several points.*

TANK-WAGON AND SERVICE STATION: *Price-cutting in gasoline retail sales applying to all grades reported at several points. Posted dealer schedules generally firm.*

FINANCIAL: *Oil stocks follow general market with slightly higher averages. Thirty representative stocks for week ending February 19: High, 29.50; low, 27.99; close, 29.42. Week ending February 12: High, 28.74; low, 27.21; close, 28.42.*

**Detailed information in Market Section.*

Annual Statements

UNION OIL CO. *of California reported for 1937 net income of $12,061,332, equivalent to $2.58 per share on 4,666,270 shares outstanding. This compares with net income of $6,133,398 or $1.40 per share on 4,386,070 shares outstanding in 1936.*

STANDARD OIL CO. *of Kansas reported for 1937 net income of $781,783 or $5.80 per share on the 134,841 shares outstanding. This included a non-recurring profit of $332,660 and compares with net income of $257,081 or $1.91 a share in the preceding year.*

SUN OIL CO. *for 1937 shows a net income of $9,544,085, equal to $4.17 each on the 2,328,380 common shares. This compares with $7,563,554, or $3.44 a share on the common stock in 1936.*

Obituaries

AL FINDLEY, formerly employed by Texas Pipe Line Co., died in Shreveport, La., February 17.

R. M. WEST, Sun Oil Co. geologist, died at Hattiesburg, Miss., February 21. Death followed operations for double mastoiditis.

J. B. (BUZZ) PIERSON, for many years manager of National Supply Co. at Cairo, W. Va., died at his sister's home in Columbus, Ohio, last week.

WARREN HARRIS, 66, founder and former president of the Harris Pump & Supply Co. of Pittsburgh, died at Camden, S. C., February 14. He was born in Salem, Ohio.

W. W. PIGUE, SR., died in Martin, Tenn., February 14. He was connected with Gulf Publishing Co. of Houston as manager for several eastern states, until his retirement last May.

J. T. PERRYMAN, 82, widely known Oklahoma and Kansas oil man, died at his home in Oklahoma City, February 17. His headquarters were in Stillwater during 14 years when he was connected with the land department of the Prairie Oil & Gas Co., which he joined in 1917.

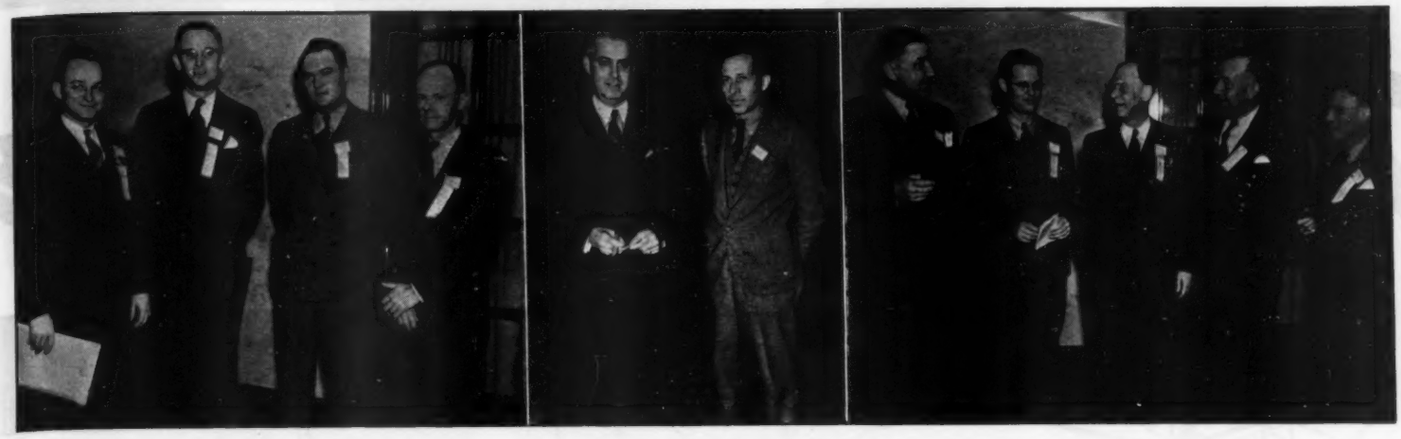
O. R. SHAFFER, 63, known as dean of Oklahoma oil scouts, died February 21 at Sapulpa, Okla., where he had made his home for more than 25 years. He was born in Enterprise, Pa., January 5, 1875. At various times he was employed in Ohio and Kansas. For a short time he worked for the Sapulpa Refining Co. He joined Texas Co. as scout in 1918.

EUGENE FRANCIS CREMIN, 61, Tulsa oil man and city resident since 1906, died February 18. He was born in Turtle Point, Pa., January 2, 1877, and entered the oil business at an early age as a field worker. He moved to Prairie Depot, Ohio, and later operated throughout Ohio, Indiana, California, Colorado, Texas, Kansas and Oklahoma. He moved to Tulsa in 1906 and became affiliated with the Eastern Torpedo Co., later taken over by Independent Eastern Torpedo Co., of which he was a stockholder.

WILLIAM WRIGHT, 70, vice president and general manager of International Supply Co. until his retirement two years ago, died February 18 in Tulsa. He was born at Hartlepool, England, in 1867, and came to this country in 1871, settling with his parents at Franklin, Pa., where he entered the oil well equipment manufacturing business. He was associated with George Maloney & Co. of Franklin for nearly 20 years. He later organized the William Wright & Co., manufacturers of oil well supplies and equipment, which he operated until 1908. He then moved to Bradford, Pa., where he became associated with Bovaird & Seyfang Manufacturing Co. as general superintendent. He moved to Tulsa in 1915 and joined the Oklahoma Iron Works as general superintendent.

JAMES WALLACE SLOAN, 68, of Tulsa, president of the International Supply Co., died February 21. A native of Allegheny City, now Pittsburgh, Pa., he had been active in the oil industry from Pennsylvania to Mexico for over 40 years. After service in Texas with Producers Oil Co., later absorbed by Texas Co., he organized Sour Lake Tool Co. at Corsicana. He moved to Oklahoma in 1904, founding the Cleveland Tool Co. at Cleveland and two years later moved to Tulsa where he purchased the Tulsa Foundry Co. He formed the Oklahoma Iron Works in 1907 which affiliated with International Supply Co. last March. Mr. Sloan was also president of Bradshaw Oil Co. and vice president of Thompson Oil Co. During his pioneer days in Texas he was associated with Walter Sharp, J. S. Cullinan, Col. E. H. R. Green and John W. Gates.

J. W. SLOAN



First group: C. H. Keplinger, C. E. Sturdevant, Van D. Bennett, and H. M. Hutchinson. Second group: E. O. Bennett and J. C. Johnston. Third group: Carl A. Young, A. J. Holland, R. C. Kay, Mason King of Amarillo, and C. A. Daniels

New Form of Texas Proration Hinted at Amarillo Session

By MITCHELL TUCKER

AMARILLO, Tex., Feb. 18. — A carefully planned and well balanced program, embracing many of the important advancements in engineering and operating practices during the past year, as well as subjects of immediate interest, made for a very successful spring meeting of the Mid-Continent District A.P.I. Division of Production, which closed here today. Pumping and drilling problems, oil well cementing and shooting, pressure maintenance, gas-oil ratio control, study of reservoir data, and personnel problems were among those discussed. Amarillo was host to approximately 400 oil men from Kansas, Oklahoma and Texas who attended the two-day session.

H. M. Hutchinson, Empire Oil & Refining Co., was unanimously elected chairman of the Mid-Continent District for 1938-39, succeeding Van D. Bennett of British American Oil Producing Co., Tulsa. Other new officers include: C. H. Keplinger, Shell Petroleum Corp., McPherson, Kans., vice chairman for Kansas; A. J. Holland, Texas Co., Pampa, Tex., vice chairman for the Texas Panhandle; T. J. Hamilton, Phillips Petroleum Co., Oklahoma City, vice chairman for Oklahoma; and Henry Miller, Lario Oil & Gas Co., Wichita, Kans., secretary-treasurer.

Following a welcome by Mayor Ross D. Rogers of Amarillo, Col. Ernest O. Thompson, of the Texas Railroad Commission, chairman of the Interstate Oil Compact Commission, opened the session with a forceful discussion of market demand, curtailment of new taxes, and possible future proration measures in Texas.

Thompson on Allocation

Colonel Thompson briefly outlined a new method of state allocation which is receiving serious consideration in Texas at this time. Such a plan as tentatively considered would put every well in Texas upon its marginal allowable as provided by statute (varying according to producing depth). If wells are incapable of making their marginal, they will be granted just what they can make. This would absorb about 850,000 bbls. of the Texas daily demand. The remainder would be allocated by giving allowables above marginal to wells and fields in the percentage that market demand above marginal allowable bears to the ability of wells and fields to produce.

Colonel Thompson roundly denounced the proposed excise tax on fuel oil now before congress, saying it was absurd to consider such a move as a revenue measure, as, if imposed, the fuel oil market would be unable to compete with coal prices, and with the recession of sales no revenue would accrue to the government. Other of the highly unfair aspects of the proposed tax were cited.

Personnel Problem

The program committee gave attention to perhaps the most important requisite in successful oil field operation—its personnel. Two papers were devoted to this subject. L. K. Covell, state supervisor of trade and industrial education for Oklahoma, first spoke on "Vocational Training in the Oil Industry." Oklahoma and Texas are now cooperating in the development of material for this program in conjunction with the A.P.I.

Mr. Covell pointed to the growing interest in this opportunity for self-education shown by the fact that 1,065 men are attending 52 classes now being offered at 27 centers in Oklahoma, and about 2,000 men in Texas are enrolled in 41 classes at 26 centers. Very careful study is given to the courses offered. Where the background of certain employes is not sufficient to permit them to enter more advanced courses, they are offered elementary studies and a systematic opportunity to develop. Supervised vocational courses are now being offered in Texas and Oklahoma on such subjects as: Drilling practice, internal combustion engines, mathematics, natural gas, basic sciences, electricity, shop practice, welding, blue-printing, machine work, refinery practice, cracking, repressuring, grade school review, etc. "This plan of adult education in the petroleum industry," Mr. Covell said, "is the service department where industry may take advantage of the development of men in the same manner that it calls upon maintenance departments to service machines, to see they are kept up to the peak of production."

"Use of Hydraulic Pumping in the Mid-Continent" was the subject of a paper by J. F. Crawford, British American Oil Production Co., published in this issue of The Oil and Gas Journal, page 81.

Pressure Maintenance

E. O. Bennett, of Continental Oil Co., opened the Thursday afternoon session with an interesting presentation of his subject, "Unitization of Leases and Pressure Maintenance," on which he is considered an authority. In addition to Mr. Bennett's remarks of a general nature, he cited two specific examples which served to establish the advantages that may be expected from pressure maintenance work. The repressuring of depleted sands may properly be considered a secondary recovery method in the form of pressure restoration, while the more desirable procedure is obviously to operate oil fields under a system of pressure maintenance from the beginning. Of the two specific examples cited, one was the Cook Ranch field of Shackelford County, Texas, where ultimate recovery has been increased from 7,500,000 bbls. to an indicated future recovery of 20,000,000 bbls. The other example was the high-pressure maintenance gasoline plant and field stabilizing unit operated by Continental Oil Co. in the Tepetate field of Arcadia Parish, Louisiana.

In the presentation of his paper on "The How and Why of Oil Well Shooting," Paul F. Lewis, manager of American Glycerine Co., reviewed the old haphazard shooting practices, and in contrast discussed the more recent developments in methodical methods. The author particularly stressed the size of the shot, its point of application, and the advantages of tamping.

(Continued on Page 54)

Modern Pumping

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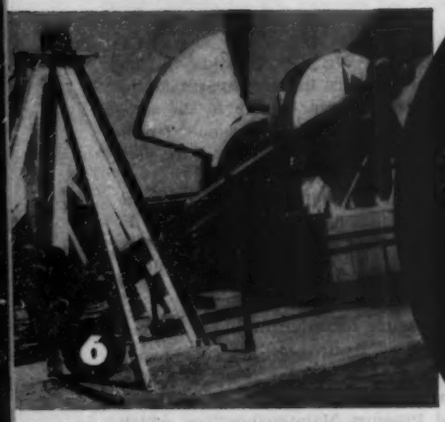
The most complete line of Pumping Equipment available in the Oil Country today.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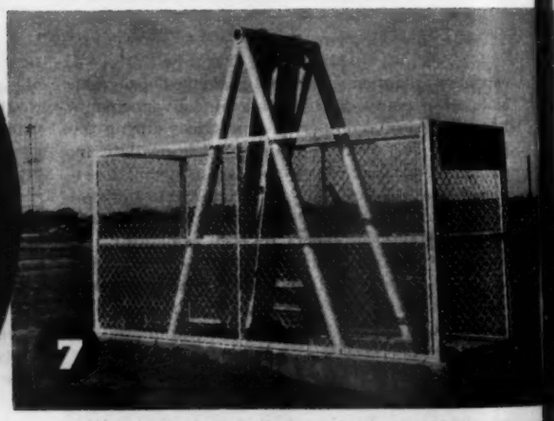
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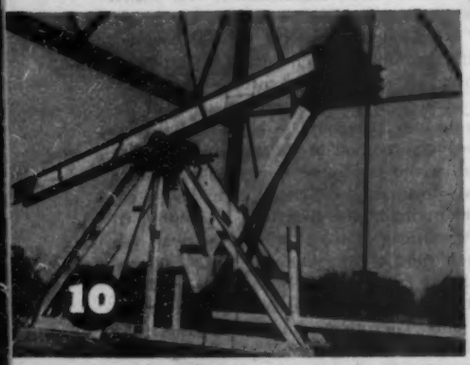
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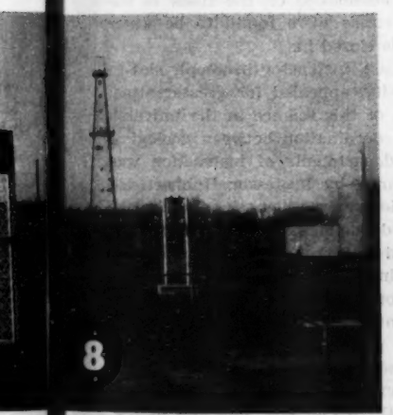
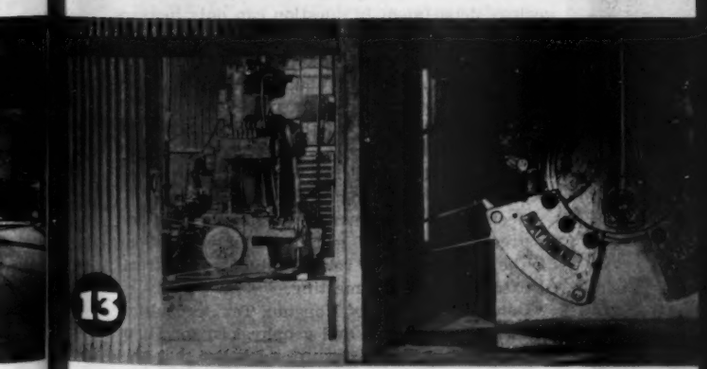
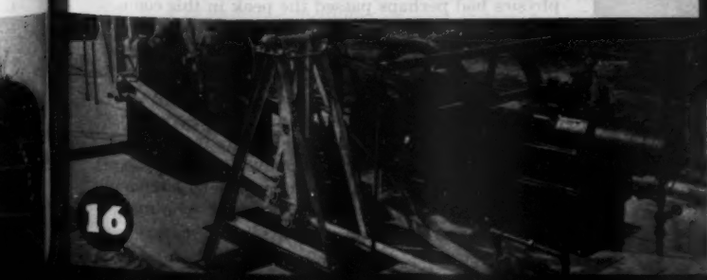
Oil Equipment







1. UNIT PUMPERS
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3. REDUCTION GEARS
4. BACK CRANK PENDULUMS
5. FOUR WELL HOOK-UPS
6. THREE WELL HOOK-UPS
7. HOLD DOWNS
8. HOLD OVERS
9. THROW-OFFS
10. PUMPING JACKS
11. GEARED POWERS
12. BAND WHEELS
13. SUPERIOR VERTICAL PUMPING ENGINES
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He also included a discussion of the favorable results which have been had in the Panhandle and other areas where concentrated shots are used at the most suitable points in the hole.

Cementing

The need for careful water analysis of oil well waters, and the use of proper cements to meet the particular conditions at hand, was stressed in Svend Rodam's paper on "Sulfate Resisting Cements for Oil Well Cementing," which was read by Henry Sessums, both of Trinity Portland Cement Co., followed by motion pictures of the manufacture of cement, and interesting scenes in Louisiana and Texas fields.

C. P. Parsons, vice president of Halliburton Oil Well Cementing Co., reviewed the rapid developments in the efficient squeezing of oil well formations for the purpose of reducing gas-oil ratios or shutting off formational water. In discussing certain successful jobs, Mr. Parsons said: "These uncanny results have not been flukes, nor just a few jobs scattered here and there. There have been several thousand jobs during the past year with squeezing pressure up to 5,600 pounds per square inch, and averaging around 3,000 pounds, without shutting off the oil." Among recent developments which have led to the present form of squeezing mentioned were better cementing technique, better cementing equipment to handle high pressures, special cements to set slowly under high temperatures, self-sealing fibered cements, packers and back-pressure valves, bridge plugs, electrical logging, wall scrapers, and gun perforators.

Electrical Logging

"Application of Electrical Logging Methods to West Texas Problems," was the subject of a paper prepared by W. J. Gillingham and W. B. Stewart, of the Schlumberger Corp., and was presented by Mr. Gillingham. Three divisions were made in the paper: (1) Electrical logging as an aid to correlations; (2) temperature measurements for determination of gas-oil contacts; and (3) source of waterflows by means of photoelectric instruments. Both the theory and several specific field examples were given in the discussion of temperature surveys for the purpose of determining gas-oil contacts for casing seats, completion procedures, and the eventual reductions in gas-oil ratios.

In the second paper dealing with personnel matters, G. O. Lockwood, Cities Service Oil Co., Bartlesville, Okla., spoke on "Accident Prevention in the Oil Industry," wherein he outlined a comprehensive but workable safety program with respect to both its organization and administration. In conclusion he stated, "We, as an industry, have done much to eliminate the uncertainties of our operations. The same ingenuity will enable us to eliminate many of the risks with which we are concerned in our safety problem. If this is accomplished, it will be because executives, supervisors, employes and safety men all bend their efforts to achieve this end. With the increased interest in safety evidenced by our industry, the results of our safety efforts should place our record at the top."

The showing of a large number of slides effectively illustrated the talk on "The Hazardous Use of Oil Pressure Vessels in Oil Fields," by G. Raymond, chief engineer for Black, Sivalls & Bryson, Inc. Lantern photographs contrasting proper and improper welding methods, high pressure vessel construction, newly developed technique of x-raying welds, and allied problems, were shown.

Modern Trends

"Modern Trends in Rotary Equipment and Drilling," was the subject assigned J. E. Brantly president of Drilling & Exploration Co., Inc. Mr. Brantly supplemented his book on the subject by discussing recent advancements in drilling equipment technique, as well as pointing out need for additional improvements along certain lines.

"To summarize this paper very briefly," he concluded, "we are vastly in need of, and the trend is toward, drilling equipment of design and characteristics more nearly suitable to the work to be accomplished, and machinery that will have a longer useful life and require lower upkeep costs."

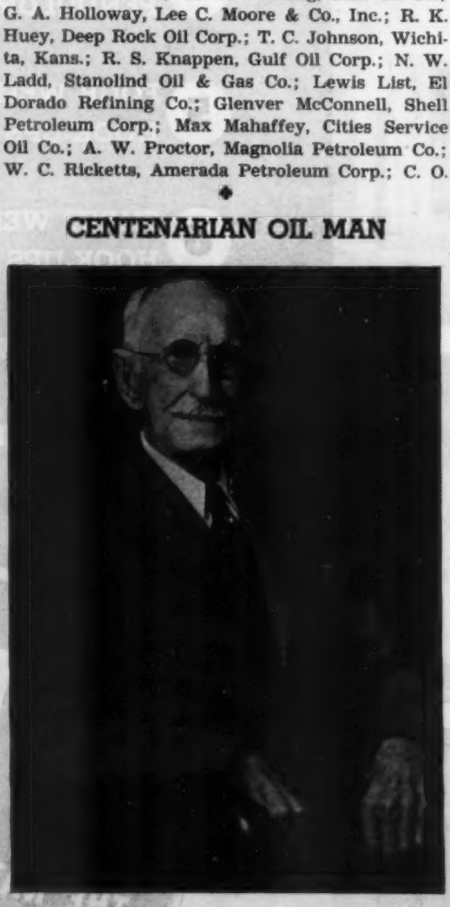
In conjunction with E. H. Clayton of the same company at Midland, Tex., Mr. Brantly also presented a preliminary discussion of the use of pulverized limestone as rotary drilling mud in West Texas, permitting drilling-in with rotary tools. In such practice, the sand is later cleaned by a light charge of acid.

W. S. Walls, research engineer for Phillips Petroleum Co., Bartlesville, Okla., correlated much of the literature published thus far on the determination of well productivities from production and subsurface pressure data, as well as advancing new possibilities from intelligent interpretation of reliable information of this kind. His subject was, "Practical Methods of Determining Productivity in Reservoirs on Leases by Bottom-Hole Pressure and Core Analysis."

Advisory Committee

The following advisory committee was selected: Van D. Bennett, chairman, Sunray Oil Co.; A. S. Ritchie, McPherson Drilling Co.; L. G. E. Bignell, The Oil and Gas Journal; J. J. Conry, Carter Oil Co.; K. A. Covell, Pure Oil Co.; C. A. Daniels, Phillips Petroleum Co.; G. P. Dimit, Phillips Petroleum Co.; J. G. Dyer, Continental Oil Co.; J. K. Ellis, Transwestern Oil Co.; A. N. Pardee, Texas Co.; W. W. Fleming, Ohio Oil Co.; G. A. Holloway, Lee C. Moore & Co., Inc.; R. K. Huey, Deep Rock Oil Corp.; T. C. Johnson, Wichita, Kans.; R. S. Knappen, Gulf Oil Corp.; N. W. Ladd, Stanolind Oil & Gas Co.; Lewis List, El Dorado Refining Co.; Glenver McConnell, Shell Petroleum Corp.; Max Mahaffey, Cities Service Oil Co.; A. W. Proctor, Magnolia Petroleum Co.; W. C. Ricketts, Amerada Petroleum Corp.; C. O. Rison, Indian Territory Illuminating Oil Co.; L. E. Smith, National Petroleum News; H. M. Stalcup, Skelly Oil Co.; J. H. Stewart, Atlantic Refining Co.; E. N. Wilson, Magnolia Petroleum Co.; F. W. Floyd, Carter Oil Co.; Oscar Hotcher, Ada, Okla.; M. A. Sherwood, Shell Petroleum Corp.; J. S. Montgomery, Phillips Petroleum Co.; J. F. O'Shaughnessy, Lario Oil & Gas Co.; C. S. Warren, Cities Service Oil Co., and H. M. Hutchinson, Cities Service Oil Co.

CENTENARIAN OIL MAN



John B. Kelsey of Harlingen, Tex., who was born February 14, 1838

PETROLEUM ENGINEERS

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daily. A step-out location 600 feet west of the first well resulted in completion of a 1,500-bbl. well with the first six sand zones exposed. B.P.M. then moved a mile north and added another well flowing 1,700 bbls. Development was halted from 1932 to 1935 and during that time the three wells, which were produced consistently, declined only 6 per cent per annum.

When drilling was resumed in 1935 locations were selected with a view of obtaining maximum information on the structure. Gas-oil ratio of 500 feet per barrel was the average generally sought. Ratios exceeding the desired level were regulated by chokes, and one well near the structural axis yielding a ratio of 1,500 feet per barrel was closed in. The eight producing horizons have a total thickness of about 560 feet and since there is no practical objection to exposing any or all of the sands the individual well conditions determine the completion policy.

The field now contains 35 flowing wells. Two wells have been abandoned on the flank of the structure where sands were found to be water bearing and one is closed in.

M. King Hubbert, instructor in geophysics in Columbia University, appealed for greater attention to treatment of this science in the universities. The lack of coordination between geological and geophysical departments of instruction was especially condemned by Professor Hubbert. He said the lack of adequate mathematics and chemistry in geological departments of instruction was to be deplored and took the stand that a geologist without this training which is essential to a physicist was an inferior product.

"If a department of geology in a university prefers to retain its present status quo, it may of course do so," declared Professor Hubbert. "In that case the discrepancy between the physical knowledge of earth phenomena and that of the geology department in question can only increase with time."

In describing organization of a department of geophysics, C. A. Heiland and Dart Wantland, professor and assistant professor, respectively, of the geophysics department of the Colorado School of Mines, gave an outline of the student schedule which included engineering, mathematics, physics, geology, chemistry, languages and economics.

Geophysical instruments, their application and progress, the scope of geophysical investigations for the year, and other related subjects were treated extensively at the meeting.

Donald C. Barton, of Houston, Tex., consulting and resident geologist and geophysicist for Humble Oil & Refining Co., expressed belief that geophysics had perhaps passed the peak in this country. He said use of geophysics to a comparable extent for oil exploration abroad probably would not be reached for 10 to 15 years. He cautioned against geophysics as a career for students, pointing out that most of the departments are now headed by young men who will retain their seats for several years. He said a "geologist geophysicist" probably had greater opportunities under present circumstances than a "physicist geophysicist" who may find his career at a dead end for several years.

Non-Political Technical Board Suggested for Oil Industry

By H. STANLEY NORMAN

NEW YORK, Feb. 22.—Creation of a non-political, technical board vested with adequate authority to strengthen organs of administration within the petroleum industry was suggested by Dr. Alexander Sachs, economist, at the annual meeting of the A.I.M.E. The reactions to Doctor Sachs' suggestion were varied, it was indicated by discussions and questions from the floor at the conclusion of his address before the economics section of the petroleum division.

Some thought the suggestion might offer an escape from the frequently voiced assertion that proration, or planned production, must eventually collapse or submit to federal regimentation.

Joseph E. Pogue, vice president of Chase National Bank, New York, discussed "An Equilibrium Theory of Proration." Present regulation, said Mr. Pogue, falls short of dynamic equilibrium in that drilling is not treated in proportion to its importance. Any mechanism, he continued, either natural or artificial, for regulating the functioning of a given unit in the general economy must operate toward the maintenance of equilibrium if it is to survive.

Pioneering Spirit

Doctor Sachs sketched his hypothesis on a broad canvas and delved into the realm of general economic principles. He said the oil business is the sole surviving competitive industry containing conflicting interests and attributed this condition in a large measure to the pioneering fashion in which it has met and solved complex problems. Through the past generation, Doctor Sachs said, the oil industry has met and transcended its problems in a pioneering way.

He reverted to the period immediately following the war for his first example of how the oil industry has maintained its pioneering spirit. At that time, he said, there was a "scare" of an oil shortage, consumption was growing at an alarming rate in comparison to production and proven reserves were estimated at a level presaging exhaustion within five to eight years. The oil industry transcended this problem by finding abundant new supplies and this search, he said, led the industry face to face with its second major obstacle of the post-war era, an excessive supply. Again, the pioneering spirit in the industry sought for and found a solution in proration, which Doctor Sachs consistently alluded to as a smoothing function to cushion the bulges and slumps.

He took issue with those who believe proration is a price-fixing medium. He said it was a dynamic averager of prices, cushioning the bulges and slumps, but leaving the prices within limits completely free for movement. Waste and discontent, criticism both from within and outside the industry, Doctor Sachs said, were caused by excessive fluctuations of supply and demand.

He made the point that surplus stocks of any industry, accumulated to the extent that they cannot be liquidated within a year, cost in the neighborhood of 20 per cent per annum. He declared stocks of such magnitude that they could not be liquidated within a year were of necessity born by the speculative element in finance.

Because of proration, Doctor Sachs declared, the petroleum industry was enabled to continue its discoveries, to continue its technological development of producing and refining methods to the end that it is clearly at the top of the social functional enterprises.

Proration was considered by the speaker as having three dimensions: (1) A means of maintaining equilibrium between supply and demand; (2) a means of conserving an irreplaceable natural resource; and (3) a means of promoting the economic progress of the industry itself. The oil industry drew commendation for its technique in administering cooperative results in a highly competitive industry. The competition, Doctor Sachs maintained, was never more keen despite opinions to the contrary which are heard now from the economic illiterate. The industry was also commended for developing forms of reconciliation between cooperative action and complete regimentation.

JOSEPH E. POGUE

Oil was classified as a capital commodity and as such requires a fulcrum in this country's economic system, which Doctor Sachs said in the case of petroleum consisted, in his opinion, of proration. Extending his consideration of proration as a fulcrum, Doctor Sachs said political pressure may be expected to develop when the balances are disturbed.

It was at this juncture of his address that the economist advocated creation of a non-political bureau of technicians within the industry to deal with its own economic problems. He cited the automobile industry as an outstanding example of what can be done in the matter of meeting economic issues within the business.

His specific recommendation was for establishment of technical divisions of the Interstate Compact Commission with authority and remuneration in keeping with magnitude of the task. Taking similar bureaus in Great Britain and their method of selection as an example, he suggested the American Petroleum Institute, the Independent Petroleum Association and comparable institutions within the industry elect a group of qualified individuals to be classified as nominating trustees. From the group of nominating trustees, the Interstate Compact Commission would make its selections from the technical bureau which would function as an economic referee.

Economic Spacing

From the discussion which developed later, it was brought out that Doctor Sachs had in mind the economic aspects of spacing as well as other functions within the industry. Since the states have a stake in the economic soundness and progress of the petroleum industry, even in those where the interest is confined to motor fuel tax revenues, Doctor Sachs assumed that to gain acceptance was not impossible of achievement.

Earl Oliver, of Ponca City, Okla., who has interested himself in the stabilization work of the A.I.M.E. and other institutions of the oil industry for years, raised the question of where corrective measures should be applied. He injected the thought that the causes for recurrent disturbances might be sought in preference to the quest for results.

There were many parallels between the address of Doctor Sachs and the paper by Mr. Pogue, although the latter concluded his remarks, which dealt largely with the history of proration, by posing six questions. He did not attempt to answer the questions, but said:

"The mere formation of these questions may illustrate how the criterion of equilibrium may serve to focus attention upon the development that proration has already attained and the nature and complexity of the problem it still faces. A great American industry is engaged in constructing a new operating form and the outcome of this effort will be of the broadest interest."

The questions asked by Mr. Pogue were:

1. Does proration contribute to the efficient utilization of reservoir energy in the production of crude oil? And is this contribution progressing in the direction of neutralizing the effects of the rule of capture through the furtherance of collective action in the single oil pool?

2. Does proration induce a balancing of supply and demand, without, in so doing, creating

(Continued on Page 60)

Natural Gas News

Oil and Gas Conference at State College, Pa., in May

The seventh annual petroleum and natural gas conference, sponsored jointly by the School of Mineral Industries of Pennsylvania State College, the Pennsylvania Grade Crude Oil Association and the Pennsylvania Natural Gas Men's Association, will be held at State College, Pa., May 27 and 28, it has been announced by Dr. Sylvan Pirson, chairman.

Line from Lloydminster to North Battleford Planned

REGINA, Saskatchewan.—C. H. Withers announces that as soon as weather permits he will start construction of 85 miles of 6-inch gas line and distributing lines from the Lloydminster field to the town of North Battleford, Saskatchewan.

U. S. Supreme Court Decision In Laredo Case Important

WASHINGTON, D. C.—The validity of rates fixed in the city of Laredo, Tex., for sale of gas by the United Gas Public Service Co. was upheld by the U. S. Supreme Court. The action to enforce the rate was instituted in the state courts although the company had instituted proceedings in federal courts. The question at issue was whether state courts had jurisdiction.

AUSTIN, Tex.—Ernest O. Thompson, member of the railroad commission, hailed the Supreme Court decision in the Laredo gas case as affirming "the rock on which we have stood in our gas rate regulation." Similar conditions prevailed and similar rules were observed in cases of 302 other towns, he said, "so I feel confident that this decision marked the beginning of the end of our fight for fair gas rates in Texas."

Attorney General William McCraw said several points decided by the Supreme Court would have a bearing on the pending Lone Star Gas Co. case. Rates in 300 Texas towns are affected in the Lone Star case which was initiated after the Laredo case, the first in Texas to be tried before a jury.

Mr. McCraw called attention to two important phases in the Laredo decision. The court upheld the retroactive phase of the railroad commission order reducing rates in Laredo from 75 cents per 1,000 feet, less 10 per cent discount for prompt payment, to 55 cents. The order issued June 13, 1933, was made effective January 1, 1932, the day the commission took jurisdiction.

The court ruled, Mr. McCraw said, the commission was within its power to reduce rates when it found that operating costs justified a lower rate.

Union Gas Co. of Canada Earnings Show Increase

CHATHAM, Ontario.—Earnings of Union Gas Co. of Canada, Ltd., including earnings of its subsidiaries, City Gas Co. of London and Windsor Gas Co., for the nine months ending December 31 were $457,370 compared with $266,220 in the same period of 1936, due partly to increased number of customers and partly to increased househeating sales owing to colder weather.

I.C.C. Increases Freight Rates on Carbon Black

WASHINGTON, D. C., Feb. 21.—The Interstate Commerce Commission has granted proposals by railroads for a freight rate increase of 5 cents a hundred pounds on carload shipments of carbon black from producing points in Louisiana, Texas and Oklahoma to Gulf ports for export and coastwise movement.

The commission ruled a similar increase on shipments from the three states and Wyoming to other points in the United States and Canada was unjustified. It ordered increased rates, which had been suspended, cancelled.

Refinery Expansion

Bids for Diesel Oil Contract Asked by Navy Department

LOS ANGELES, Calif. — Southern California oil companies have been asked by the Navy Department to bid on a contract for 230,000 bbls. of diesel oil for the United States fleet. The contract is one of the largest ever offered for this type of fuel by the department and will approximate $445,000. Principal use of the fuel will be for submarine operations, but a large portion will be distributed to naval bases for blending with stored oil.

Richfield Awarded Contract For Lubricating Oils

LOS ANGELES, Calif.—The state of Washington will use Richfield Oil Corp. lubricating oils and greases exclusively during 1938. Award of a contract to supply the state's entire needs for greases and oils, including the demands of highway equipment, state institutions and the state penitentiary, has just been made to Richfield by the Department of Finance, Budget and Business of the state of Washington. It is estimated that the total volume involved in this award will exceed 100,000 gallons during the ensuing year. Award of this business to Richfield is the third major contract of like nature announced by the company in almost as many weeks.

Small Canadian Refinery To Be Enlarged

EDMONTON, Alberta.—Dina Oil & Refining, Ltd., operating a small refining plant in the Dina-Ribstone field of east central Alberta, will extend and improve its equipment, following a visit by Stuart Wright to similar heavy crude plants in the California fields.

Union Oil Places Order For Large Tankship

LOS ANGELES, Calif.—Union Oil Co. has placed the order for a new oil tankship, to be the largest and fastest in its entire fleet, with the Bethlehem Shipbuilding Corp., Ltd., according to an announcement by W. L. Stewart, Jr., vice president of the

SUMMARY OF NATURAL GAS STATISTICS, 1936

State—	Production: Millions of cu ft.	Production: Average value at wells per thousand cu. ft. (cents)	Production: Average value at points of consumption per thousand cu. ft. (cents)	Consumption: Domestic (inc. commercial): Thousands of consumers	Domestic: Millions of cu. ft.	Domestic: Average value at points of consumption per thousand cu. ft. (cents)	Industrial: Field—drilling, pumping, operating gasoline plants, etc.: Millions of cu. ft.	Field: Value (thousands of dollars)	Manufacture of carbon black: Millions of cu. ft.	Carbon black: Value at points of consumption (thousands of dollars)	Fuel at petroleum refineries, electric public utility power plants, and other industrial consumption: Petroleum refineries	Electric public utility power plants	Other industrial	Value at points of consumption thousands dollars)*
Alabama				28	1,761	88.6	.....	.....	.....	.....	.....	.....	14,869	2,407
Arkansas	8,500	6.6	21.2	71	8,483	48.1	6,562	484	.....	.....	2,865	2,246	10,830	2,014
California	320,406	6.5	25.7	1,517	69,258	82.8	136,808	8,363	.....	.....	31,269	20,840	62,231	16,683
Colorado	3,687	3.3	21.9	97	5,601	77.2	450	26	.....	.....	3	371	13,288	2,162
Illinois	865	8.8	50.1	1,137	22,108	120.7	959	98	.....	.....	231	2,033	46,825	9,113
Indiana	2,241	15.3	60.5	74	1,763	97.8	398	35	.....	.....	.....	7,998	8,405	3,421
Iowa				115	4,643	90.9	.....	.....	.....	.....	.....	4,541	11,734	2,346
Kansas	69,178	4.7	33.4	212	22,665	51.7	15,702	1,361	.....	.....	2,428	16,056	25,174	5,830
Kentucky	43,903	12.2	43.7	172	10,410	54.2	764	98	.....	.....	.....	.....	6,985	1,928
Louisiana	290,151	3.1	18.5	169	13,080	57.6	24,953	1,282	46,357	1,109	9,552	25,916	46,627	9,095
Michigan	7,167	8.8	49.5	519	6,365	119.5	1,812	160	.....	.....	.....	.....	2,965	1,321
Mississippi	11,821	4.3	22.4	38	4,182	49.7	.....	.....	.....	.....	.....	1,211	5,975	931
Missouri	399	14.8	49.1	387	13,962	81.0	189	31	.....	.....	.....	4,862	21,111	4,786
Montana	23,003	3.6	27.0	37	8,600	39.5	1,522	67	.....	.....	435	700	8,637	1,464
Nebraska				114	5,810	72.5	.....	.....	.....	.....	.....	2,981	7,989	1,878
New Mexico	33,928	1.7	16.2	16	1,916	58.1	12,063	324	.....	.....	72	2,601	3,162	788
New York	12,431	22.2	69.5	402	17,060	80.2	122	38	.....	.....	2,297	3,969	17,190	4,618
Ohio	46,994	16.3	47.1	1,249	69,852	59.2	1,799	323	.....	.....	15	3,421	46,294	16,131
Oklahoma	280,481	2.4	10.3	254	27,734	42.1	189,986	5,803	(†)	(†)	9,030	8,148	†25,222	†3,862
Pennsylvania	110,362	19.6	38.8	690	43,891	60.6	5,259	1,380	.....	.....	1,587	805	58,653	16,774
South Dakota	9	6.7	33.3	15	2,119	58.7	.....	.....	.....	.....	.....	878	2,064	502
Tennessee	84	4.8	33.3	43	3,930	65.0	.....	.....	.....	.....	.....	4,229	3,754	1,389
Texas	734,561	2.3	15.5	598	43,987	65.5	204,341	6,498	228,286	2,382	27,530	36,496	57,448	16,498
West Virginia	138,076	14.8	39.7	188	23,271	36.2	9,206	1,841	.....	.....	651	71	24,779	6,164
Wyoming	29,322	3.0	15.6	23	3,976	38.2	5,528	183	(†)	(†)	5,214	405	†5,030	†699
Other	233	6.6	50.6	459	18,182	79.6	45	2	8,778	190	4	5,302	25,934	5,437
Total 1936	2,167,802	5.5	22.6	8,674	454,969	67.1	618,468	28,397	283,421	3,681	93,183	156,080	554,397	138,051
Total 1935	1,916,595	5.8	22.4	8,004	413,685	68.5	580,414	27,225	241,589	3,787	80,175	125,239	468,799	113,736

*Includes value of gas used at petroleum refineries and electric public utility power plants. †Gas used in manufacture of carbon black included under "other" for United states total and under "other industrial" for state total to avoid revealing figures of individual operators.

oil company. The new tanker will be built at Bethlehem's Sparrows Point plant, near Baltimore. Delivery of the vessel is scheduled to take place in about 12 months. A. O. Pegg, Union's superintending engineer, has left for Baltimore to supervise construction of the vessel.

The new tanker will augment the oil company's domestic fleet, consisting at present of 10 capital ships. It will be the first major addition to Union's fleet since 1922, and will be of 13,000 tons deadweight and will have a capacity of over 100,000 bbls. of oil. Sea speed will be 12½ knots. Overall length will be 463 feet, with a beam of 64 feet and a depth of 34 feet, 10 inches. The tanker will have a draught of 28 feet, 4 inches.

New Louisiana Refinery Nearing Completion

SHREVEPORT, La.—Co-Service Oils, Inc., headed by Douglas MacDonald, is nearing completion of its new refinery at Princeton, La., and expects to place the plant in operation shortly after the first of March. The plant will be of 750 bbls. daily capacity and will manufacture lube oils, blown asphalt and greases. A skimming plant is expected to be placed in operation about April 1. The company's main offices are in Shreveport.

Natural Gasoline

Canadian Gasoline Sales Increased During 1937

OTTAWA, Ontario.—Canadian gasoline sales for the 11 months of 1937 ending November 30 showed a total of 672,292,000 gallons compared with 581,326,000 gallons in the same period of 1936. All nine provinces showed increases for the 11-month period. The 11 months' total for 1937 compares with a total of 624,116,000 gallons for the entire 12 months of 1936.

Imports of natural gasoline lighter than .6690-gravity in December were 2,455,914 gallons valued at $185,131, all from the United States; comparing with a total of 6,500,893 gallons valued at $445,813 the previous month. Of the latter, 3,986,033 gallons valued at $269,249 came from the United States and the remainder from Peru. Of the year's imports, amounting to 46,752,596 gallons valued at $3,086,462, some 29,009,484 gallons, worth $1,939,342, were from the United States and the remainder from Peru.

Imports of gasoline lighter than .8235-gravity in December were 1,684,379 gallons valued at $145,276 compared with 1,825,660 gallons worth $164,718 in November, all from the United States, including Alaska. Of the year's imports, totaling 25,725,505 gallons valued at $2,301,672, some 24,983,823 gallons valued at $2,250,520 came from the United States and Alaska while Rumania contributed 735,000 gallons valued at $50,491, with the remainder from Great Britain.

Exports of gasoline and naphtha in December were 376,503 gallons worth $45,503 against 73,100 gallons worth $6,128 in November. For the year such exports totaled 4,300,115 gallons valued at $400,800.

First Oil From Temblador Field in Eastern Venezuela

NEW YORK, Feb. 21.—The first oil from the Temblador field, in the southern part of the state of Monagas in eastern Venezuela, was shipped from Boca Unocoa on February 16 consisting of 19,000 bbls. of 23 (A.P.I. gravity) crude. Temblador field production is being transported to Boca Unocoa through a 10-inch pipe line, a distance of about 32 miles, and is there picked up in shallow draft tankers and moved to the deep water terminal at Caripito for transhipment to Aruba. Four wells are tied into the line and production is averaging about 4,200 bbls. per day. More wells are being tied into the line and will contribute to increased output from the field in the near future. Temblador production is obtained from depths varying between 3,500 and 4,000 feet. The production is owned by Standard Oil Co. of Venezuela (Standard of New Jersey).

Pipe Line Activity

Lining up a joint on a gas line

Royalite to Increase Capacity Of Lines in Turner Valley

CHATHAM, Ontario.—Officials of Royalite Oil Co. Imperial subsidiary, have announced the company's decision to increase the capacity of its pipe lines from Turner Valley to Calgary to a total of 24,000 bbls The announcement by J. H. McLeod, president of the Royalite company, says:

"The first pipe line from the field to the Imperial refinery at Calgary was laid in 1925. It was a 4-inch line with a capacity of 5,000 bbls. a day and proved adequate for all requirements of the field at that time. When Imperial took over the Regal refinery and its line to the field it extended the line from the Regal refinery to its own plant, and thus raised the pipe line capacity then to 10,000 bbls. a day.

"When suddenly increased supplies of crude oil late in 1937 made a greater clearance necessary for an expanding field, the company inserted a loop of 6-inch pipe from the valley field which extended over the hill and joined the old Regal 4-inch pipe about 30 miles from Calgary. This larger connection on the intake end of the old Regal line raised the capacity of this line by about 3,000 bbls. and advanced the total to 13,000 bbls. a day. The southern end of the Regal 4-inch line from the field to the junction of the loop was no longer used.

"Facing the difficulty of providing increased facilities for the movement of crude, the company has now decided to have three lines all the way from the field to railhead at the East Calgary plant. The connection between the 6-inch loop and the Regal 4-inch line will be disconnected. The Regal line will then be reinstated from the field to the tanks in Calgary and deliver its capacity load of 5,000 bbls. a day. The present loop portion of 6-inch pipe will be extended into Calgary and this new, larger capacity pipe will provide an outlet for 14,000 bbls. a day.

"When this is laid Calgary deliveries will then be coming in at 5,000 bbls. flow over the original 4-inch line, another 5,000 bbls. from the old Regal 5-inch line and 14,000 bbls. from the new 6-inch line, providing a total capacity of 24,000 bbls. a day."

The 6-inch line, including the existing loop, will be about 45 miles in length. Improvements to the Royalite carrying facilities in 1937 and 1938 will reach an estimated cost of $810,000. The Royalite company will continue its policy of transporting the production of all companies, whether under contract to market to Royalite or not, subject to proration under government regulations and subject also to the assurance of the producer that his crude will be removed from the terminal storage tanks within 30 days.

Lone Star Gas Completes 18-Mile Leon County Line

FORT WORTH, Tex.—Lone Star Gas Co. has completed its 18-mile pipe line extension in Leon County to serve gassers purchased from Shell Petroleum Corp. in the Buffalo field. The 18-inch extension ties in with the company's 12-inch carrier extending from the Long Lake field to Central Texas towns and cities. Three gas wells, on the Lee, Beggs and Jones leases, are now directly connected with the new gathering line.

Lone Star has a 20-inch main extending from Long Lake, through the Cayuga field in Anderson and Henderson counties, and extending to Dallas.

I.C.C. Fixes Valuations For Three Companies

WASHINGTON, D. C., Feb. 21.—The Interstate Commerce Commission has fixed valuations for three pipe line companies. The appraisals, for property owned and used for common carrier purposes as of December 31, 1934, are:

International Pipe Line Co., operating in Montana, $325,000; Atlas Pipe Line Co., operating in Texas and Louisiana, $1,400,000; Spartan Refining Co., operating in Arkansas and Louisiana, $750,000.

Continental Pipe Line Co. To Lay Lateral in Kansas

Right of way has been secured for a 14-mile pipe line lateral to be strung at once by Continental Pipe Line Co. to the Ainsworth pool of Barton County and the Trapp pool of northern Barton and southern Russell counties, Kansas.

The line will comprise 10 miles of 6-inch pipe and 4 miles of 4-inch line. Oil picked up from 49 tank batteries in the two fields will be handled through the main line pumping station of the Continental Pipe Line Co. at the southeast edge of the Ainsworth field.

Osage Construction Co. of Great Bend, Kans., has been awarded the contract.

Three-state Effort to Level Crude Supply to Demand

The Corporation Commission of Oklahoma will meet on Monday, February 28, to determine the real market demand for crude oil and to decide on the allowable production during March. At a meeting of purchasers and producers held on February 17 in Oklahoma City with the state oil conservation department, the consensus was that 450,000 bbls. per day would supply the demand for Oklahoma crude and it is expected that at Monday's meeting an allowable no higher will be decided upon. The allowable for the latter days of February was 500,000 bbls. a day.

Conservation Officer William J. Armstrong favors the reduction to 450,000 bbls. per day, but his difficulty lies in where to curtail. In a letter to buyers and producers, he says: "If this 50,000 bbls. is to be taken off the prorated areas only it will mean a cut of approximately 16⅔ per cent of every well and every lease in all prorated areas, because the allowable from the prorated areas amounts to approximately 335,000 bbls. per day."

Overproduction in Oklahoma and in Kansas has been going on for some time. Large buyers of oil have been, and are now, storing crude, and may even be obliged to store some oil with production cut 50,000 bbls. a day.

Kansas purchasers have been cutting their takings from central and western fields. Stanolind Crude Oil Purchasing Co. issued notice February 18 that the following day it would reduce its purchases in Kansas to 85 per cent of the allowable fixed by the corporation commission, minimum wells excepted. The reduction will amount to about 2,500 bbls. per day and affects pools in Russell, Barton, Rice, Stafford, Reno and Rooks counties where the company buys oil. It made a similar curtailment in Ellis County six months ago, still in effect. No time limit is placed on the company's curtailment program.

Sinclair Prairie Oil Marketing Co., Phillips Petroleum Co. and Texas Co. are all said to be curtailing purchases in Kansas to a more or less degree.

The Bureau of Mines estimate of demand in Oklahoma in March is 547,700 bbls. per day and Kansas 176,700 bbls. per day, but the facts do not support these estimates.

No Saturday Shutdown in Texas, Commission Says

AUSTIN, Tex., Feb. 22.—Assurance Texas oil production would not have to be shut in a second day each week was given by members of the railroad commission at the statewide proration hearing. Warnings had been given previously that if crude and gasoline stocks continued to mount rapidly it might become necessary to make further drastic reductions in production, possibly adding Saturdays to the present Sunday shutdowns.

Operators were told at the hearing that if they could "rock along" for another 30 days without changes in the present allowables or disturbing the setup, conditions might work themselves out satisfactorily. However, a question was raised when Col. E. O. Thompson suggested the best course might be to reduce production of all wells of the state to a marginal basis, and then start out from "scratch" in allocation of allowables to meet market demand.

Such a procedure would reduce the state's production about 885,000 bbls. daily at once, Colonel Thompson said. Inability of many wells to make their marginal allowance would provide additional allowable that could be distributed proportionately among wells able to produce, he said, and as requirements for oil developed, additional allowable could be granted these wells.

Statewide Sunday shutdowns were initiated January 23. As a result production now is slightly over 141,000 bbls. less. Allowable production February 18 was 1,474,580 bbls. Although this was 69,340 bbls. greater than the allowable production January 15, it represented, considering the Sunday shutdowns, a daily average allowable production of only 1,263,926 bbls., or 141,314 bbls. under the January 15 allowable.

The Bureau of Mines estimate of market demand for Texas during March is 1,344,900 bbls., a decrease of 20,800 bbls. from that for February.

TECHNICAL BOARD

(Continued from Page 57)

other maladjustments that will tend to upset this balance? And in bringing about such a balance, does proration leave price free to express natural values and perform properly its functional duties?

3. Does proration operate to preserve capital equilibrium, so that the proper amount of capital is drawn into the business, but redundant capitalization is avoided?

4. Is proration making adequate advancement toward bringing about a suitable relation between demand and "potential" production? Is not much greater progress needed in changing methods of administration so as to retard the drilling of unnecessary wells? Is proper headway being made toward the institution of allocation formulas and well-spacing patterns designed to preserve equilibrium both in the single reservoir and in the economic structure?

5. Does proration promote sufficient flexibility in trade channels to permit their orderly adjustment to changing requirements, with due regard to relative costs and size of reserves? And are its allocation procedures such as to stimulate orderly development and retard improvident operations?

6. Is proration approaching adequately the problems lying in the sphere of coordination between the oil-producing states? Is the legal instrument devised for this purpose, the Interstate Oil Compact, meeting its responsibilities with sufficient energy and skill to safeguard this field of operation from attachment by a higher central authority?

Mr. Pogue traced proration from its inception when the need first arose for a quicker acting and less drastic stabilizing influence than provided by price adjustment alone. In the administration of proration, said Mr. Pogue, the conservation and stabilization aspects have become inextricably commingled. It is true, of course, he said, that if proration is applied under circumstances of disequilibrium when prices are subnormal, the price structure will respond with an upward movement; and contrariwise, a lapse in proration, permitting overproduction, will result in a price decline. As both conditions have happened in the past, with the designated price reaction, it is but natural that proration has become known in some quarters as primarily a price-fixing measure.

"Yet it must be clear," said Mr. Pogue, "upon consideration, that if proration brings about a perfect balance between supply and demand, that action alone has no effect upon price other than to allow it in an orderly manner to seek an equilibrium level; that is, a level responsive to cost, buying power, and the capital requirements of the industry."

Sharp issue was taken in the economic session by John D. Gill and E. T. Knight of Atlantic Refining Co. with critics within and without the industry who have employed the verbiage "superior" and "inferior" uses of petroleum in their attacks. Especially condemned, they said, has been the use of natural gas for the production of carbon black and the use of heavy fuel oil under steam boilers.

"Many of the critics," wrote Mr. Gill and Mr. Knight, in their paper on "What Are the Uneconomic Uses of Petroleum?" "have been sincere advocates of the conservation of natural resources; many others, and in recent years probably the majority, have been pseudo-conservationists with the all too obvious ulterior motive of restricting the use of petroleum to further the prosperity of other industries. The latest advocates of severe restriction in the use of petroleum for the alleged purpose of conserving petroleum resources propose to achieve that end by a bill, now before the house of representatives, which provides for the levying a heavy, discriminatory sales tax upon fuel oil. It has been suggested that the secondary, if not indeed the primary, purpose of the proposed tax is the expansion of markets for anthracite and bituminous coal by lessening competition from fuel oil.

The authors then pointed out that production of motor fuel by cracking petroleum fractions as light as gas oil and even kerosene, resulted in production of heavy fuel. Of the 310,000,000 bbls of viscous fuel oil produced last year, probably upwards of 150,000,000 bbls. resulted from the cracking of light oils, they said.

Unavoidable Waste

Admission was made that physical waste may have occurred in the petroleum industry, but that currently it is confined to commercially unavoidable causes. In satiating the rapidly expanding demand for motor fuel, the absence of which would have prevented the present growth of the automotive industry, large quantities of heavy fuel oil were unavoidably produced. There was no other way, said Mr. Gill and Mr. Knight, to clear the way for producing the increasing quantities of gasoline. By developing the art of refining, oil companies have reduced the proportions of so-called "inferior" products, but the absolute production of them increased. Impediments to the development of the petroleum industry which would be set up by the taxation of fuel oil sufficiently severe to withhold large quantities of crude petroleum from the use of the present generation were pointed out. A rise in the price of gasoline, with a greater burden saddled on automobile drivers, is inevitable, it was declared, if a punitive tax is levied on fuel oil, as it must of necessity move in competition with other fuels.

Turning from the defense of heavy fuel oil uses, the authors took up natural gas used in production of carbon black. Their stand was that carbon black used as the abrasive ingredient of automobile tires has elevated this use to a level comparable with domestic heating consumption. Tires in which carbon black is used as a reinforcing agent last from two and a half to three times as long as those made with the next most suitable material. Conservatively, it was stated, over the past 15 years, the saving to the public in the form of longer-life tires has been upwards of 40 times as much as the value of natural gas employed for the production of all carbon black manufactured in this country for whatever purpose, even when valued at the well at the average price realized for natural gas from the same source put into the domestic heating market.

Business Man Explains Problems to Employes

A recent address to his employes by Percy C. Jones, president of the S. M. Jones Co., of Toledo, Ohio, has caused considerable comment. The talk is presented herewith:

PERCY C. JONES

You have been making sucker-rods this last year and I have been trying to run the business and sell the rods. During the year, I traveled 40,000 miles by air not counting rail and auto—that is at the rate of over 3,000 miles a month. You made the rods and I sold them. You put your labor into the rods, and I sold your labor. I want you to see that when you have worked eight hours, five days a week or more, I have had to travel nearly 100 miles a day on an average for the year of about 700 miles a week—selling the rods and selling your labor.

The point is that we are all working together for the same purpose, that is, to turn the steel and your labor into rods and to sell the rods for the money to pay for your labor and the steel.

You will be stating the facts if you say that I am your salesman.

Now here is what you fellows can do next year, and, if you do it, it will help a lot.

The elimination of waste is up to you. I think you can do it without working any harder or longer. All you have to do is to find the waste and help cut it out. All that is required is good team work and fine, friendly cooperation on your part and mine. If you will do your part, I will do mine. I will travel 100,000 miles next year if necessary, if that will show you that I appreciate honest, hearty cooperation.

Just Horse Sense

Another thing—I have been told that I must not speak to you because I might unfairly influence you in some way because of the Wagner act or because to do so might frustrate collective bargaining or something. Well, when the time comes that I cannot speak to you, when and as I please, and you cannot speak to me in exactly the same way, we probably will be out of business. As long as I am traveling 40,000 miles a year to sell the rods, which includes your labor, I guess I can talk to the men whose goods I am selling, and you can talk to your salesman—that is that.

Now so far as concerns this collective bargaining business, there is nothing that will take the place of horse sense. I do not want to see the day when any man in this plant is afraid to talk to me or to complain to me or to see me about anything that is on his mind. I do not want to see the day when you cannot come to me individually or in groups or by a committee or in any way you please. I hope I shall never fail to talk sensibly and fairly with you regardless of what we are talking about.

Remember now, and don't forget it, come in to see me any time you feel like it. Talk to your foreman or to the superintendent first, if you please, but see me if you want to.

Tell Your Grievances

The Wagner act says that an employer is not permitted to advise his employes as to joining or not joining an organization, and any time an employer does talk to his employes, as I am talking to you, he is likely to have some one jump on him or file a complaint with the Labor Relations Board to complain that he is coercing his employes.

When there was talk about organizing this shop, you went at it in your own way and formed an employe organization, and the directors of that organization came to me and we entered into a written contract which was duly signed by the company and the committee. That organization was not induced or suggested or fostered or brought about by the management in any way. I know you can prove to anyone that you did that job yourselves, and that you did it because you believed from past experience you could always come to me or anyone connected with this company and talk matters over at any time, day or night.

Now that organization can do all of you and do the company a lot of good if you will see to it that it attends to its business, which is to represent and speak for employes in the presentation and discussion of grievances or matters touching employment. You all know that any one of you is perfectly free at any time to see me or the superintendent or anyone else, but there are always some men who are reluctant to let it be known that they have a grievance—some men are afraid that the foreman, superintendent or management will give them the worst of it if they tell what is on their minds. I do not want any man in this plant to feel that way, and I do want the grievance committee of your organization, or whatever you call your committee, to do a good job in seeing that nobody around this plant harbors a just grievance. That committee ought to separate the wheat from the chaff by deciding what grievances are silly and what ones ought to be talked about, but whenever that committee finds a real, substantial grievance in this shop, they must make it their job to see that it is brought to the attention of the company.

If you had an infected and aching tooth, you would have it filled or pulled. You would take care of that tooth before you got rheumatism or any other of the troubles that can come from a bad tooth.

On the same principle, I want to get at and I want your committee to get at any reasonable grievance or complaint that any employe in this plant may have at any time. I want to pull or fill that tooth. I want to do what is right to correct the grievance. If the employe is wrong, I want to get the facts and let him see that he is wrong. If the management is wrong, I want the management to admit it promptly and correct its error.

Cooperation Needed

This is the kind of cooperation you owe to the management and it is the kind we owe to you, so let us be sensible about it and do as nearly right as we know how.

Now I want to talk to you again about the business. I think you will agree that I know something about this business and how it should be run. Forty-five years ago last September I went to work in this plant, and I checked the first carload of steel that was unloaded for making sucker-rods. I helped to run the first string of these sucker-rods that were ever put in an oil well. I am the oldest sucker-rod man that is still standing on two feet.

A lot of you have been in the plant 40 years, 30 years, 25 years, 20 years and 15 years—long enough to know the manufacturing end of this business as well as I do. I have told you that I am satisfied there is enough loss and waste in this plant that can be eliminated to make it worth while for everybody—worth while for you and worth while for the company. We cannot pay dividends or increase wages out of waste.

I want you and every one of you to see that it is your job to cut out waste and loss wherever you see it, and it is your job to bring to the attention of the foremen, the superintendent or myself any ideas you may get as to the way to reduce costs, improve an operation, or make a better product.

Almost any one of you can help in both directions—by cutting out waste and by improving operations and making a better product. You can do this without working any harder or working any longer. I am not talking about any speed-up, but I am talking plain common horse sense, and I want to see you all get at this and do a good job at it from now on.

Cut Out Waste

I want to tell you why it is up to you to cut out this waste and improve our operations.

The fact that I have to travel a very great deal and our sales organization is constantly endeavoring to sell our rods is proof enough that the rods will not sell themselves. I want you to know that there are five big manufacturers of sucker-rods in the United States, four of them are tied up, directly or indirectly, with and affiliated with the big steel companies, and only one is independent. That one is your company. You can see that we have to hump to keep these big companies from getting on our toes. We are the first manufacturers of metal sucker-rods. Everyone in the industry knows that every improvement in sucker-rods originated in our factory. When we normalized steel, the others followed. They have trailed behind and copied us in the use of normalization of steel, the use of automatic screw machines, the use of steels of different analyses, and in every other way.

In spite of this terrific competition we still lead as the world's largest manufacturers of the best sucker-rods that money can buy.

I want you to see that keeping ahead of the parade calls for the hardest kind of effort on the part of the management and calls for the kind of cooperation I am asking you to give.

There is just one other thing I want to talk about, and then I will close. Your wages have to be paid in cash. We cannot pay you in sucker-rods or scrap metal or worn-out machinery or bricks or mortar. When we have to pay you or pay for materials or pay taxes, we have to have the money, because only money talks. I want to tell you something about the practical operation of this undivided profits tax that you read about in the papers every day. Here is how it works with your company.

Though we are paying you in cash, the dividend that we pay to our larger stockholders has to be paid in two-year notes.

We have to pay that dividend in notes because

(Continued on Page 274)

Exploration and Drilling Abroad Are Entering Upon New Area

NEW YORK, Feb. 21.—Foreign oil-producing countries are heading into the most intensive exploratory and development eras ever known. This conclusion was drawn from the symposium on foreign oil developments presented in New York last week before the petroleum division of the American Institute of Mining and Metallurgical Engineers in annual session. Throughout the world reports stated or implied that drilling is to be intensified in the proven fields and pushed into scores of remote spots heretofore unexplored.

In many of the countries touched upon in the reviews covering 1937, the future development programs are still in the embryotic stage. Beyond the factual remarks of the engineers reporting on developments, however, was the unmistakable conclusion that 1938, 1939 and 1940 will bring unprecedented drilling activity. In some instances it is indicated by the large companies in acquisition of land. In other cases the programs have proceeded to actual drilling with prosecution planned for 1938 and subsequent years. South America figures prominently in the programs. However, Central Europe, the Near East, Netherlands East Indies, Australia and less-known isolated spots are potential areas for the intensified search for petroleum.

The symposium again emphasized the record production of petroleum during 1937. Figures on individual countries did not vary materially from earlier estimates, probably because final totals are still unavailable from some more remote countries.

One inducement to foreign oil search is the availability of comparatively extensive concessions which lend themselves to "rational" development. Elimination of the often uneconomical competitive development requirements in foreign operations is, in a large measure, compensation for the difficulties of dealing with alien powers under sometimes annoying conditions. There are numerous countries which encourage exploration of their natural resources by qualified oil companies. Several countries have modified or extended their laws to attract expenditures by oil companies within their borders and to eliminate obstructions which crept into the land laws before petroleum development was considered. Land laws have been revised in Colombia to open potential areas to oil exploration and thousands of hectares have been acquired by companies and applications are pending for several thousand additional acres.

Australia has modified its land laws and established a government fund for furtherance of oil exploration. Egypt, although not reviewed at the A.I.M.E. session, is another country in which laws have been modified to make prospecting more desirable, and the companies are taking advantage of the opportunities.

Several of the older producing countries will take precedence over the potentially productive but unproven lands in immediate drilling. The review of Poland is particularly striking, where it is estimated that approximately 1,574,800 feet of drilling will be required in 1940 with smaller increases for 1938 and 1939 if the country is to maintain its production and extend output by 10 per cent. The projected requirements in Poland alone will call for the drilling of about 800 wells in 1940.

High points of the 1937 reviews presented at the A.I.M.E. meeting follow. In the reports will be found, in some instances, the factors indicating the potential development programs even though direct reference is missing. Manuscripts reviewing several foreign producing countries were not received in time for the meeting, it was explained by B. B. Zavoico, of Houston, geologist for Chase National Bank, N. Y., who presided at the meeting.

AUSTRALIA

By W. G. Woolnough, Australian Commonwealth Geological Adviser

Extensive exploration is now in progress in Australia under an act passed by the Commonwealth government in May, 1936, appropriating £250,000 to assist in the search for petroleum in Australia and the territories under its control. The sum was to be used as advances to persons engaged in the search along approved lines and in approved areas. Later the act was amended to include assistance to those engaged in preliminary geological survey and was not confined to the drilling operations alone.

It is proposed to explore the Lakes Entrance area more extensively with a government supported drilling program during 1938. West of Lakes Entrance, throughout the Tertiary Basin, traces of oil and gas have been claimed but it is still highly unproven.

Further west in the vicinity of Sale and Langford, a definite plunging anticlinal structure has been delineated, chiefly by drilling.

In the Fitzroy River Basin in western Australia, Dr. Arthur Wade, working for Freney Kimberley Oil Co., has outlined several domal structures and has indicated that the eight wells drilled earlier were all off structure.

Queensland is the most active state. Detailed geological work by Oil Search, Ltd., led to drilling a well at Warooby Creek, 6 miles east of Roma, in 1934, resulting in gas which is now shut in. At Hutton Creek, 60 miles north of Roma, some indications of gas have been encountered at 3,715 feet in a well still drilling. At Arcadia dome, 85 miles north of Roma, a well has been drilled with an inadequate percussion plant to 4,110 feet. Large volumes of gas were encountered at 3,055 and 3,170 feet containing from 72 to 80 per cent carbon dioxide, 11 to 12 per cent methane, 4.7 to 7 per cent inert gases and about 2 per cent of ethane and lighter. The government is supplying a heavy-duty rotary rig for deeper drilling.

Structural features have been mapped 8 miles northeast of Roma where an old well drilled by Roma Blocks Oil Co. in 1929 encountered a showing of oil just above bedrock at 3,561 feet. Mapping has since indicated this test to have been on the extreme flank of the structure and further exploration is promised.

In New South Wales, Oil Search, Ltd., has surveyed much of the Hunter River basin north of Sydney thence southward to and beyond Sydney and discovered two closed domal structures. Fifty miles north of Sydney, on Kulnura dome, a test has reached 5,450 feet.

At Mulgoa dome, 30 miles west of Sydney, a closed structure in Triassic rocks has been drilled to 3,125 feet. Consideration is being given to installing heavier drilling equipment.

In Papua and New Guinea, several major oil companies have taken concessions under the new legislation, involving large expenditures in preliminary operations. While it is known that, in some instances, promising structures are under investigation, the reports of operations are confidential.

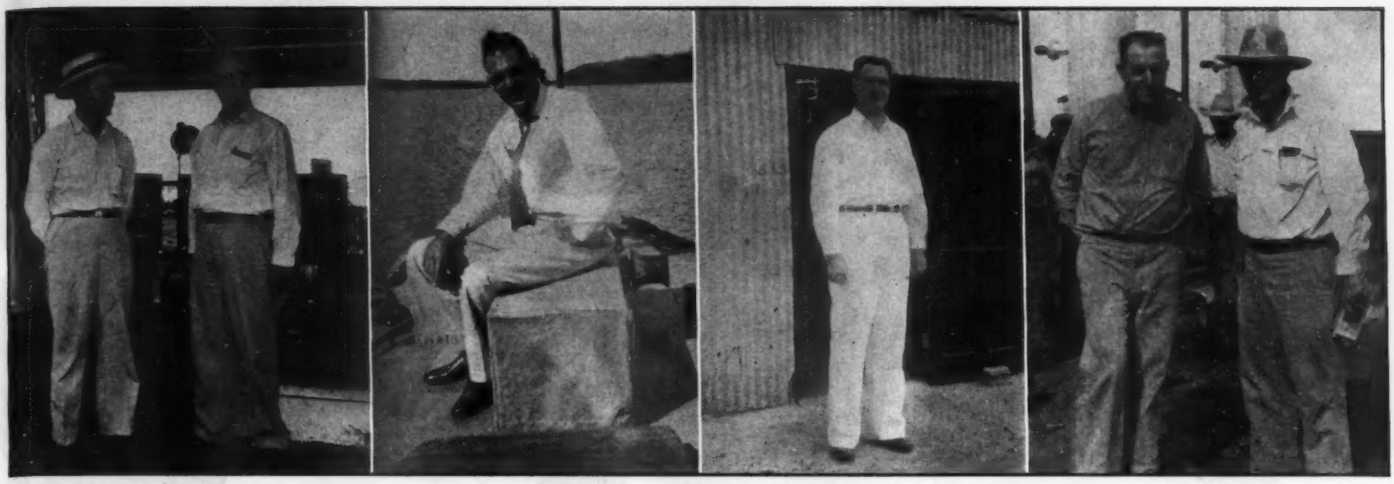
Parinas Point, most westerly point on coast of South America

MEXICO

By V. R. Garfias and A. C. Gernandez, Cities Service Co.

Mexican crude oil production totaled approximately 46,738,000 bbls. for 1937, an increase of 5,571,000 bbls. over 1936. Most of the increase came from Poza Rica, where, although only two wells were completed during the year, production increased from 14,162,000 bbls. to 18,634,000 bbls. in 1937.

The southern fields (Golden Lane) produced at approximately an unchanged rate, but the northern fields showed an increase of 1,930,000 bbls., due largely to the fact that 1936 output was curtailed below normal by strikes. Isthmus of Tehuantepec



E. E. Peak, district superintendent, Lagunillas, and J. O'Brien, assistant general manager, Lago Petroleum Corp., Lake Maracaibo; T. H. Jenkins, district superintendent, Standard of Venezuela, Pedernales; Ted Carter, district petroleum engineer, Lago Petroleum Corp., La Salina district, Lake Maracaibo; John Nation, production superintendent, and Royal Brackeney, assistant production superintendent, Standard of Venezuela, Temblador, eastern Venezuela

fields declined about 596,000 bbls. in 1937, due to labor trouble.

Crude processed in Mexican refineries increased from 34,000,000 to about 36,650,000 bbls. and exports totaled about 22,700,000 bbls., a drop of 500,000 bbls. Domestic consumption, exclusive of ship's bunkers, reached 20,000,000 bbls., out of which gasoline requirements totaled 3,400,000 bbls., an increase of 500,000 bbls.

One of the Poza Rica completions extended the field a mile and a quarter southeast, increasing the proven area to an estimated 8¼ square miles.

The market for heavy crude cargoes, f.o.b. Tampico, increased from $1.11 at the end of 1936 to $1.35 by the middle of March, 1937, but in September the price dropped to 96 cents, remaining unchanged to end of the year. The average price for spot cargoes of heavy Mexican crude for preceding years is 95 cents for 1936; $1 for 1935; 80 cents for 1934; 60 cents for 1933; 44 cents for 1932; 55 cents for 1931; 60 cents for 1930; 65 cents in 1929, and $1.05 in 1928. Southern crude not controlled by refiners sold for 55 cents per barrel at the well during 1937, compared to 45 cents in 1936.

MEXICAN OIL TAXES

(U. S. currency per barrel)

Product—	1936	1937
Heavy crude	$0.117	$0.127
Light crude	0.188	0.204
Fuel oil	0.168	0.184
Refined gasoline	0.117	0.120
Natural gasoline	0.252	0.257
Refined kerosene	0.074	0.093
Crude kerosene	0.152	0.190
Lubricants	0.148	0.148

AUSTRIA, HUNGARY and CZECHOSLOVAKIA

By Brandon H. Grove, Socony-Vacuum Oil Co., Inc.

AUSTRIA: The Zisterdorf field, near Vienna, is the only producing field in Austria. The field was extended slightly in 1937 by Rohol Gewinnungs A.G. No. 2 Rag, which produced initially about 850 bbls. per day through 8 mm. choke from the twelfth Sarmot sand at 1,447 meters. Water encroachment increased to 50 per cent of production after a few months. Two subsequent extension tests, No. 3 Rag and No. 5 Rag, northeast and west of No. 2 Rag, found only water at the productive horizon. Both tests encountered the main fault and entered Flysch at 1,683 and 1,401 meters, respectively. Both tests are now being deviated from the fault and are to be drilled deeper.

In the field proper, Erdolproduction No. 7 Gosting developed into the area's largest well flowing 440 tons, more than 3,000 bbls. daily. The same company's No. 8 Gosting produced 20 tons daily and No. 11 is nearing testing stage after revealing a favorable Schlumberger log.

HUNGARY: North European Gas Co., an affiliate of Standard Oil Co. of New Jersey, developed Hungary's first important oil production in 1937. The company's first wildcat at Budafa-Puszta (Lispe) in southwestern Transdanubia, near the Jugoslavian border, flowed an appreciable volume of gas and a small quantity of crude oil through 20 mm. choke early in the year. The gas and oil production came from lower Pannonian between 1,066 and 1,136 meters. Operators moved three-quarters of a kilometer east for a second test and at 1,168 to 1,179 meters developed crude production of 70 tons daily through small choke.

The second Budafa-Puszta well is now producing about 50 to 60 tons of crude daily through 5 mm. choke and the oil is being moved through a short line to a nearby railroad for shipment. North European Gas Co. has moved 1½ kilometers east of No. 2 for a third test on the structure which appears to be of important proportions.

The Hungarian government succeeded in developing a small field at Bukkszek on the edge of the plain 125 kilometers east and northeast of Budapest. The production comes from a spotty sand in middle Oligocene at about 100 meters. Out of 14 wells drilled, eight have produced some oil averaging initial of about 1 ton daily.

CZECHOSLOVAKIA: The Hodonin field production declined despite efforts of Apollo to maintain the output by drilling several wells. Faults have limited the field. Other developments within the country were of slight importance.

The government field at Ghely, in Slovakia, increased its production appreciably, but it is still small. The success at Ratiskovice a year ago proved of brief duration. The well stopped flowing within a month and efforts to revive it have proved unavailing. Subsequent efforts establish the nonexistence of a commercial field, in the opinion of observers.

Wildcat exploration continued during 1937 at Jasina in eastern Ruthenia. An old hole was deepened by 100 meters to 1,200 meters, but there was no showing of oil.

CUBA

By H. R. Dickerson, Atlantic Refining Co.

Cuba produced a total of 220 bbls. of oil and natural gasoline or distillate daily during 1937. The Bacuranao field was credited with production of 100 bbls. per day from several shallow wells and the Motembo and Vesubio areas contributed about 120 bbls. of natural gasoline. There were no important developments.

COLOMBIA

By O. C. Wheeler, Chief Geologist, International Petroleum Co., Ltd.

Acquisition of unexplored land and drilling reached a new high in Colombia in 1937. Much acreage is held in the Magdalena Valley above Puerto Berrio by Richmond (Standard of California), Shell, Texas and Tropical.

From Puerto Berrio to El Banco most of the land is of national ownership and concessions have been granted to Tropical, Socony-Vacuum and Shell. Others have applications for leases pending. Laterally, leases on private lands below Lebriza River have been taken over by Shell and Richmond.

Several major companies have carried on geological exploration work in the drainage basins of the Meta and Guaviare rivers in the Llanos region of eastern Colombia and some private lands have been leased or optioned.

Applications were accepted in 1937 for concessions totaling 187,879 hectares, but they have not been granted so far. Applicants, areas and size of concessions sought in 1937 follow:

Company and area—	Hectares
Consorcio Minero Nacional, Carare-Ermitano	44,258
Sindicato de Inversiones, S.A., Lebriza River	45,905
Compania de Petroles Shell, Carare River	49,906
Compania Colombiana de Petroles, Cimitarra River	47,810

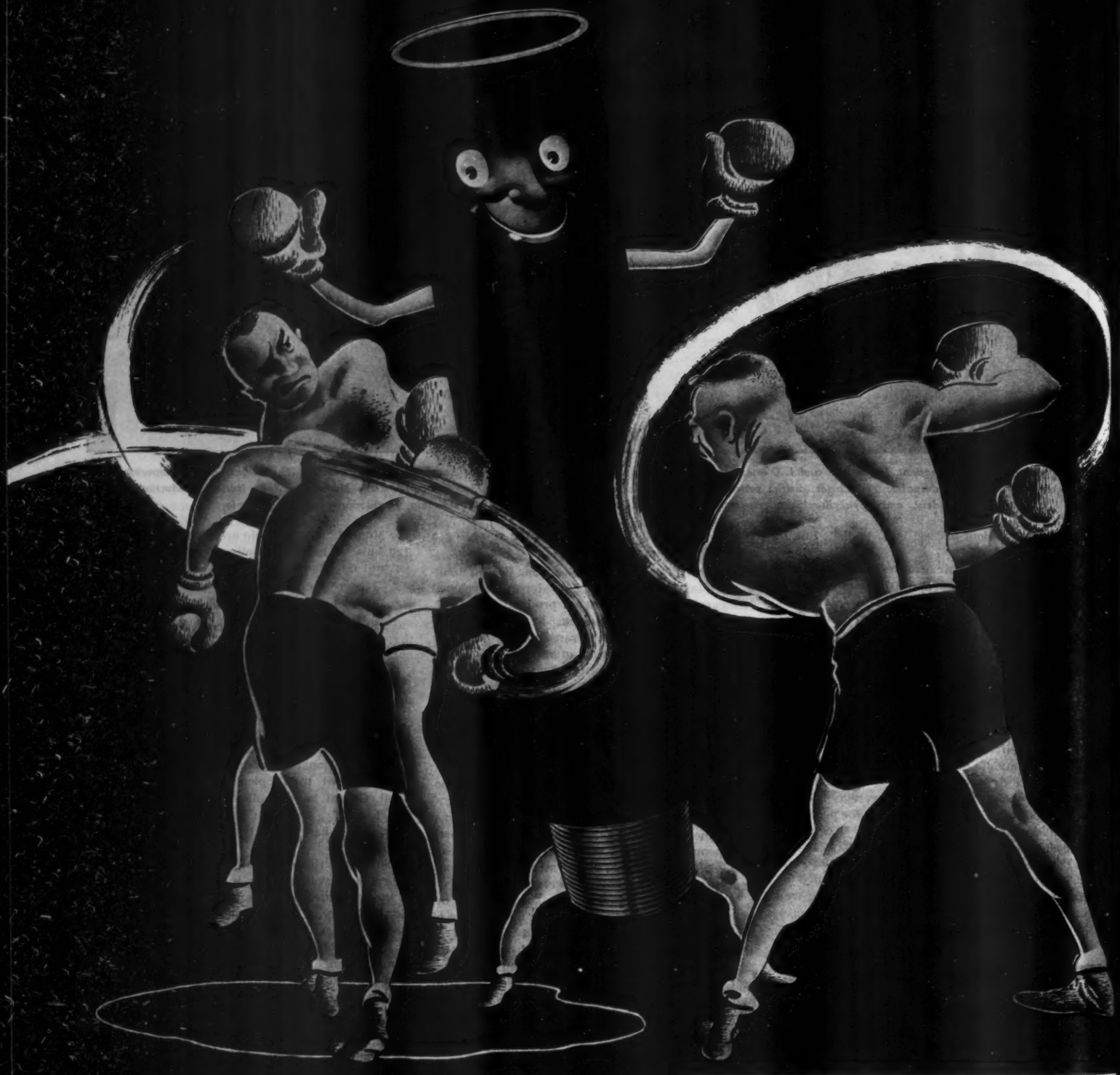
National concessions awarded from 1931-1937 follow:

Company and concession—	Hectares
Tropical Oil Co., Putana	7,430
Sociedad Nacional del Carare (under joint exploration with Tropical), Carare	33,476
Mora Concession (transferred to Shell Oct. 27, 1937), Carare	50,000
L. Restrepo Concession (transferred to Socony-Vacuum), Sogamoso	49,232

Colombian Petroleum Co., jointly owned by Texas Co. and Socony-Vacuum, completed seven wells on the Barco concession in eastern Colombia during 1937. Four were at Petrolea and three in Rio de Oro. Three Petrolea wells were producers with initial of 2,400 bbls. per day and one was a failure. Two Rio de Oro wells were producers with initial of 4,000 bbls. per day and one was a failure. At the end of 1937, 12 producing wells had been completed in Petrolea at depths ranging from 650 to 1,650 feet. The three wells at Rio de Oro range from 1,300 to 1,650 feet.

Socony-Vacuum completed one fuel-oil well be-

(Continued on Page 282)



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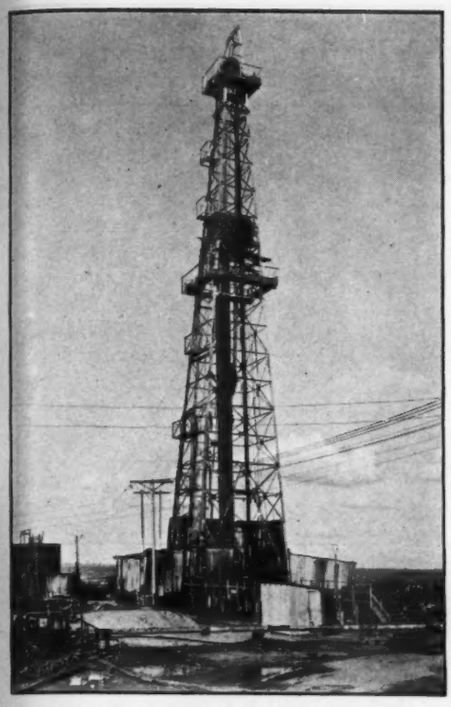
Drilling Past 13,400 Feet

By L. P. STOCKMAN



Continental Oil Co. No. 2-A Kern County Land

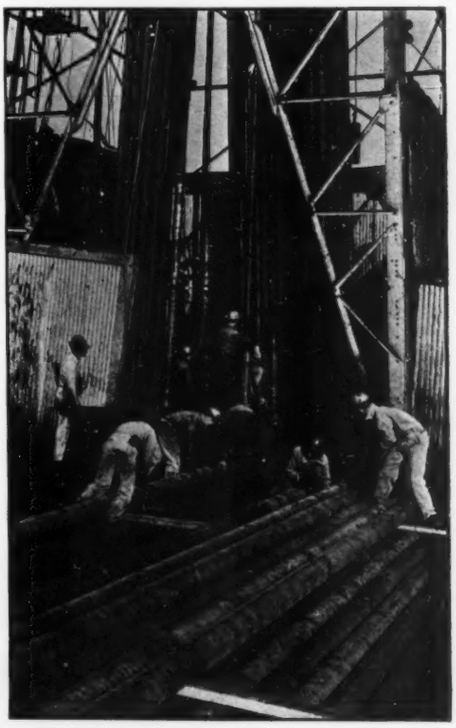
LOS ANGELES, Calif., Feb. 21.—Continental Oil Co. established a new world record for depth by drilling No. 2-A Kern County Land, a wildcat in the Wasco district of Kern County, California, to 13,460 feet and in doing so also annexed the record of having landed the second longest string of 7-inch casing.

This wildcat is the first well to reach a depth of 13,000 feet; and since it is the present intention to keep on drilling until a depth of approximately 13,500 feet has been reached, it may set a record that will remain unsurpassed for several years.

One of the most remarkable features in connection with this wildcat was the ease with which drilling operations were carried to completion; and despite the fact fast footage was made, the hole remained unusually straight. The maximum deviation from the vertical was only 22.1 feet, and the last survey taken at 11,573 feet indicated the bottom of the hole was almost directly beneath the derrick. The close adherence to the vertical was a contributing factor of no little importance in reaching a depth substantially below 13,000 feet and permitting continuance of drilling.

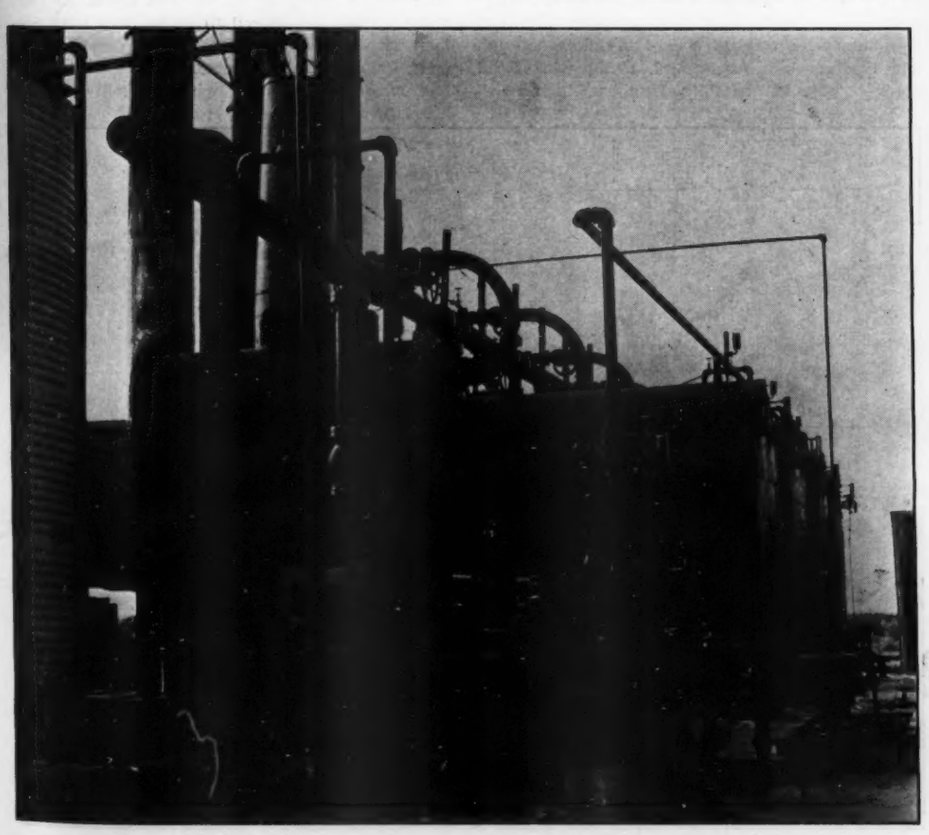
The long string of 7-inch landed at 11,573 feet consisted of 30-pound extreme line casing. It required only 8 hours and 20 minutes to run in and land the entire string, and during one hour a total of 1,790 feet of the casing was run in the hole. A little less than two hours was required to effect the cement job, using Golden Gate high temperature oil-well cement. The longest string of 7-inch casing landed previously was 12,097 feet in Humble Oil & Refining Co. No. 1 Ellender, in the Lirette field, Terrebonne Parish, Louisiana, in 1937.

Ordinarily one might question the economic importance of a 13,000-foot well in view of the high drilling cost and the excessive mortality rate incident to deep drilling, but in this instance Continental Oil Co., with several thousand acres under lease, is justified because the objective is the prolific Rio Bravo zone found by Union Oil Co. last November in No. 1-34 Kern County Land, the discovery well in the Rio Bravo field of Kern County. This zone has a higher porosity and permeability factor than any other major producing zone in California at present. The 55 feet of Rio Bravo sand cored in the Union Oil Co. discovery has a porosity of 30 per cent, a permeability of 750 millidarcies and a saturation of pore space approximately 35 per cent.



Running 11,573 feet of 7-inch 30-pound casing in 8½ hours

The well, located in section 8-27-24, is being drilled on a seismograph high which showed positive reactions similar to those recorded in geo-



Boiler battery, showing superheater and feed water pumps in foreground

physical surveys in the Ten Section, Greeley, Rio Bravo and other San Joaquin Basin fields previous to discovery of commercial accumulations and the company had reason to believe it had located a hidden structure buried beneath several thousand feet of alluvial fill and sandy shale. This is the second wildcat drilled by Continental Oil Co. on the possible Wasco structure, as No. 1-A Kern County Land, a few hundred feet southeast, was previously carried to 9,591 feet and suspended at that depth because of a complicated fishing job. The No. 1 well had excellent showings in the shale logged in the bottom of the hole and showed prospects of resulting in production, but unavoidable mechanical trouble prevented a satisfactory test. Several miniature bits and corebits were fabricated ingeniously by the company's field department and put into use to open additional formation in the hope the zone might have sufficient kick to result in a natural flow, but this work failed to produce satisfactory results.

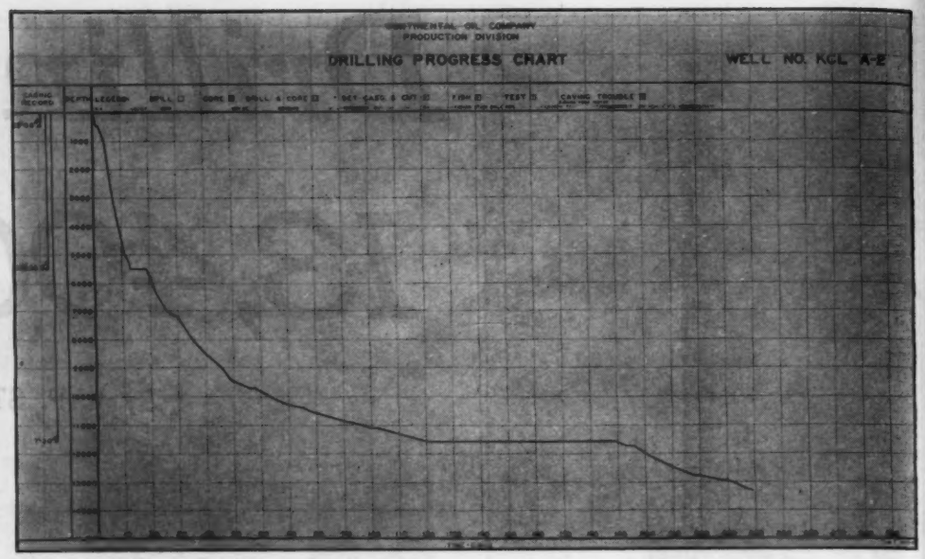
The well was spudded in June 21, 1937, passed the 10,000-foot level August 22 and reached 11,000 feet on September 27. The 12,000-foot level was attained on January 7, 1938, and the well exceeded the previous world record depth of 12,987 feet on January 31. The previous deep record was

Running in last stand to drill past world record at 12,786 feet

reached in Gulf Oil Corp. No. 103 McElroy, in the Gulf-McElroy field, Upton County, Texas, which reached 12,786 feet in May, 1935. This well was spudded March 21, 1933, and recorded several showings below 10,000 feet, but failed to find commercial production. Continental Oil Co. No. 2-A Kern County Land reached 13,000 feet on February 7, 1938, but as commercial production had not been found, drilling was continued. A fishing job of 44 days' duration developed at 11,584 feet on October 19, 1937, but this was overcome and drilling resumed. This fishing job was caused by the 4½-inch drillpipe freezing in the bottom of the hole. The fish was recovered by washing over and cutting out the drillpipe above the drill-collar, after which the collar was sidetracked and drilling operations were resumed.

The decision of Continental Oil Co. to continue drilling, after failing to find a zone similar to the productive Stevens zone in the Ten Section and Greeley fields or logging the showings found in its first Wasco test, undoubtedly reflects the successful deep drilling of Union Oil Co. in the Rio Bravo field and subsequent discovery of a highly productive zone at 11,302 feet.

Rio Bravo, like Wasco, was a seismograph high, and commercial production was expected above 9,000 feet, as at Ten Section and Greeley. When Union reached 10,000 feet without finding the Stevens zone the outlook did not appear promising and the company decided to recheck its seismograph readings. This recheck confirmed original deductions, and the company resumed drilling and logged the Rio Bravo sand. It is general belief the Rio Bravo sand ultimately will be discovered in most of the fields in the central part of San Joaquin Basin and its discovery



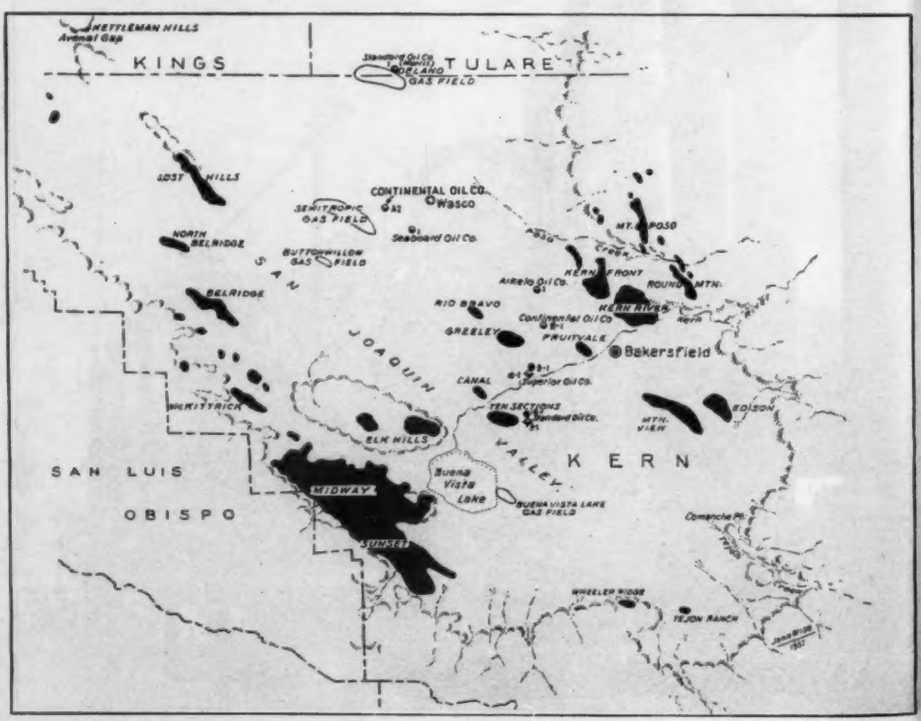
would be of paramount importance, especially since it should be found highly productive in the Greeley, Canal, and Ten Section fields. Continental Oil Co. has not yet encountered the Rio Bravo zone at Wasco, but paleontologists believe it should be found around 13,500 feet. Correlation work across the basin is extremely difficult due to marked unconformities and absence of an easily identified marker.

Bits and Corebits

In drilling to 13,000 feet Continental used a total of 72 bits and 49 corebits. The drilling-bits consisted of one 20½-inch, eleven 14¾-inch, forty 9⅝-inch, and twenty 6-inch. The 20½-inch bit was a Dunlap 4-way, and the bits measuring 14¾-inch consisted of Dunlap 4-way and Byron Jackson disc bits. In the 9⅝-inch classification there were a Dunlap 4-way bit, Chicago Pneumatic rockbits, Reed rockbits, and Hughes rockbits. The 6-inch bits were Hughes rockbits. Elliott 9⅝-inch wire-line corebits were used, along with Reed 8½-inch wire-line corebits, Hughes 6-inch hard-rock corebits, and Reed 6-inch hard-rock corebits.

The 20½-inch bit was used to 497 feet; the 14¾-inch disc bit was employed from 497 feet to 718 feet. Ten 14¾-inch 4-way bits were used in drilling from 718 feet to 5,512 feet, at which point the company switched to a 9⅝-inch 4-way bit and carried the hole to 5,541 feet. Four 9⅝-inch rockbits then were used to carry the hole from 5,541 feet to 6,916 feet, and the first series of coring was started with 28 wire-line corebits, which carried the hole to 7,205 feet. From 7,205 feet to 9,500 feet Continental used 9⅝-inch rockbits, and from 9,500 feet to 9,625 feet it used 9½-inch wire-line corebits.

From 9,625 feet to 10,200 feet 9⅝-inch rockbits were used, following which the next 69 feet from 10,200 feet to 10,269 feet was cored with 8½-inch wire-line corebits. Then 9⅝-inch rockbits were used from 10,269 feet to 10,323 feet, and the hole was cored to 10,360 feet with 8½-inch wire-line corebits. From 10,360 feet to 10,733 feet 9⅝-inch rockbits were used, and the next 15 feet of hole was cored with 8½-inch wire-line



Location of world-rec well

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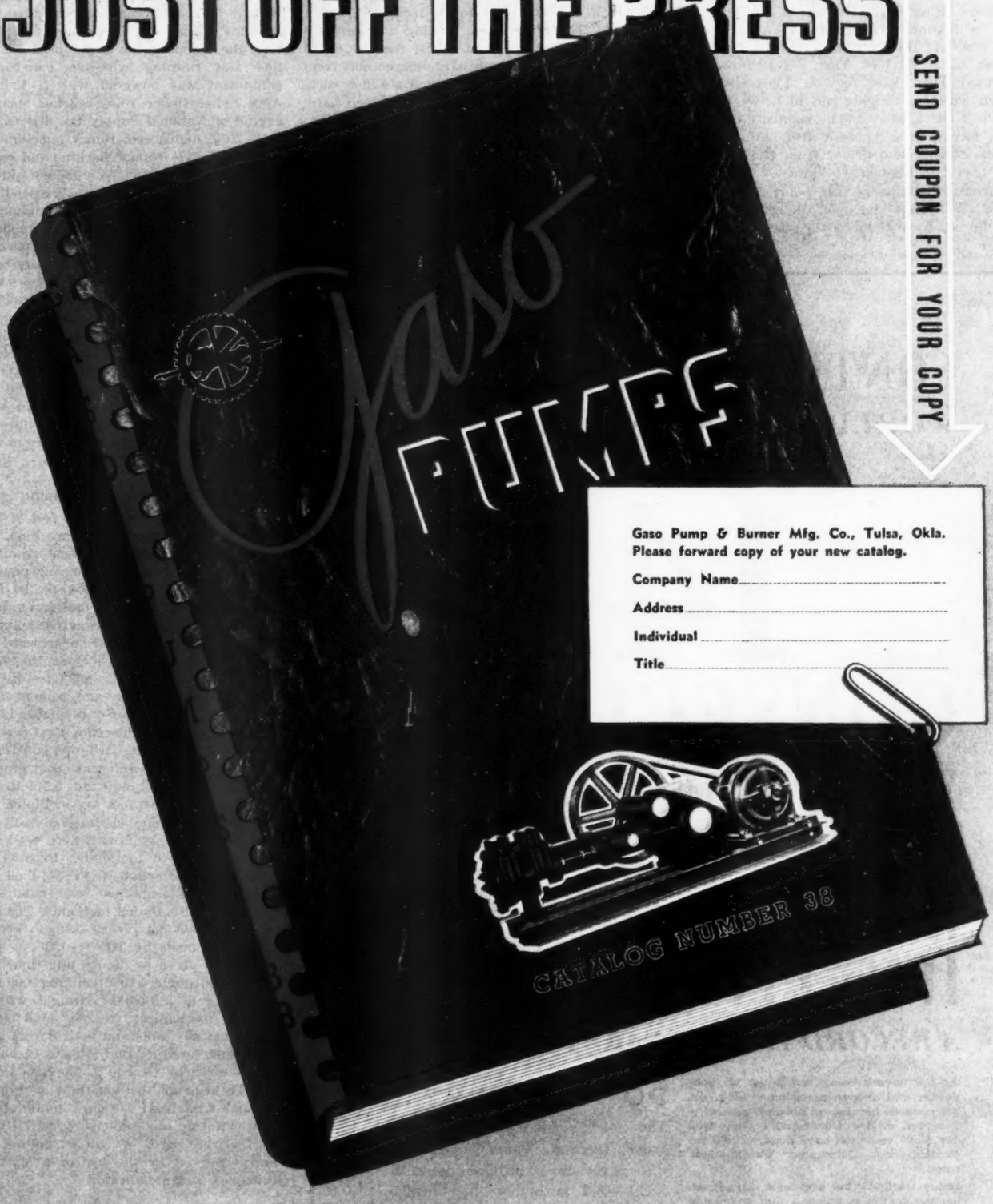

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corebits, followed by the use of 9⅝-inch rockbits from 10,748 feet to 10,864 feet. Next 8½-inch wire-line corebits were used between 10,864 feet and 11,073 feet, followed by a 9⅝-inch rockbit, which encountered 3 feet of very hard formation. The company cored immediately from 11,076 feet to 11,125 feet after getting out of this hard zone, using 8½-inch wire-line corebits, followed by 9⅝-inch rockbits from 11,125 feet to 11,246 feet and then wire-line corebits from 11,246 feet to 11,266 feet. Then 9⅝-inch rockbits were used from 11,266 feet to 11,566 feet with 8½-inch wire-line corebits run in between from 11,394 feet to 11,414 feet. The company cored 10 feet of formation at 11,566-76 feet with 8½-inch wire-line corebits and drilled from 11,576 feet to 11,584 feet with 9⅝-inch rockbits.

A frozen drillpipe at this point delayed operations for 44 days and upon the resumption of work the company reduced the size of rockbits and corebits to 6 inches. Six-inch rockbits were employed in drilling from 11,584 feet to 12,771 feet, with coring intervals using 6-inch hard-rock corebits at 11,584-11,728 feet, 11,908-51 feet, 12,017-37 feet, 12,170-12,220 feet, 12,269-87 feet, 12,388-12,405 feet, 12,502-22 feet, 12,555-69 feet, 12,603-25 feet, and at 12,640-12,771 feet. Cores with 6-inch hard-rock corebits were taken from 12,771 feet to 12,794 feet, after which drilling was resumed with 6-inch rockbits from 12,794 feet to 12,824 feet, followed by a 6-inch hard-rock corebit from 12,824 feet to 12,829 feet and then a 6-inch rockbit from 12,829 feet to 12,879 feet. A 6-inch hard-rock corebit was run between 12,879 feet and 12,888 feet, and drilling was resumed with a 6-inch rockbit from 12,888 feet to 12,914 feet, followed by a hard-rock corebit. The hole then was alternately drilled and cored from 12,914 feet to its present depth.

The derrick used was a 122-foot Ideco galvanized-steel A.P.I. drilling derrick of 465,000-pound capacity, with 6-foot extension. The drawworks was a National Supply Co. 34-26 Ideal 4-speed unitized drawworks with 36-inch roller-bearing hydromatic brake supplied by Parkersburg Rig & Reel Co. Hoisting equipment consisted of one Hopper type SS, 2-drum, 4-speed standby hoist, with 25/55 horsepower motor supplied by Hopper Machine Works. The first drum carried the deadline, the second drum being used for the sandline and running wire-line core-barrels. The equipment was powered with a 12-by-12 Ideal Ajax twin-cylinder roller-bearing steam drilling engine of National Supply Co. driving one Ideal H.S. 20½ high-speed rotary machine and one Ideal F. E. 27½ rotary machine and required the use of one 14½-by-7½-by-18-inch Ideal steam slushpump and two 14-by-7¼-by-16-inch Acme steam slushpumps. Red Devil mudpump valves of Oil Well Manufacturing Co. were used in the mudpumps, along with slushpump pistons of Mission Manufacturing Co. and a Martin-Decker mudpump pressure-gauge. Steam was supplied by four 100-horsepower 250-pound Titusville boilers supplied by Titusville Iron Works and one by Foster Wheeler portable oilfield superheater. National Gas Equipment Boilertrol combined reducing-valve and regulator, with series 1,000 N.G.E. Nelson gas burners, were used in the boilers in addition to N.G.E. burners used in the Foster Wheeler superheater. The steam lines were insulated with 85 per cent magnesium asbestos supplied by Marine Engineering Co.

Drillpipe and Casing

The casing consisted by 497 feet of 16-inch 65-pound National seamless surface pipe, 5,512 feet of 10¾-inch 55.8-pound National seamless grade D and 11,573 feet of 7-inch 30-pound Spang Chalfant extreme line casing grade D. In cementing the 16-inch seamless casing at 497 feet a Baker cement guide-shoe was used and a Baker float-shoe and cement float-collar were employed when cementing the 10¾-inch at 5,512 feet. When cementing the 7-inch at 11,573 feet a Baker cement whirler float-shoe and cement float-collar were used. A Santa Fe casinghead, made by Regan Forge & Engineering Co., was used for suspending the casing. Drillpipe consisted of 9⅝-inch Spang Chalfant internal upset grade D with A.P.I. full-hole tooljoints to 5,512 feet. From 5,512 feet to 11,584 feet the drillpipe was 4½-inch 16-pound National internal-flush external-upset grade D, range 2 with Reed 4½-inch shrink grip internal-flush tooljoints. From 11,584 feet to bottom Continental used 3½-inch 16-pound Youngstown internal-flush external-upset Grade D, range 2, with Hydril tooljoints. The kelly was a 4½-inch-by-40-foot Hydril octagon kelly with a 2-inch bore, made by The Hydril Co. Special attention was given to the drilling fluid used, and this was no doubt a contributing factor toward the drilling of a hole so straight with a minimum of mechanical trouble. Mud admixtures were found advisable and both Baroid and Aquajel, manufactured by Baroid Sales Co., and Colox, manufactured by George S. Mepham Corp., were used. To keep the drilling fluid in proper condition and free from abrasive material two McNeely vibrating mud-screens Model D4 of Vernon Tool Co. were used. Weight on bottom was constantly checked by the use of a Martin-Decker quintriplex weight-indicator.

Moving Equipment

The Regan Type B double-deck crownblock was manufactured by Regan Forge & Engineering Co. and two traveling-blocks, an Emsco 50-inch Type A-94 five-sheave traveling-block and a Baash-Ross 4-sheave 66-inch roller-bearing traveling-block, were employed during drilling. The swivel was an Oil Well Supply Co. Type 150 A swivel and the rotary hose was a 4-inch-by-45-foot Chiksan heavy-duty steel rotary hose manufactured by Chiksan Oil Tool Co. Byron Jackson

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supplied the elevators and tongs and Baash-Ross and Midway Fishing Tool Co. furnished the fishing tools. The chains were a Rex Chabelco on 1030 and a Rex Chabelco Champion on 1240 manufactured by Chain Belt Co. The hooks consisted of one Ideal 9-inch spring casing-hook and one Byron Jackson 300-T triplex-hook. A Merco Nordstrom full opening valve was used for completing shut-off and a Regan Type K blowout-preventer manufactured by Regan Forge & Engineering Co. was also used. The wire line was American 1⅛-inch lang-lay and regular Leschen 1⅛-inch regular-lay and this was spooled and guided with a Grizzly wire-line spooler manufactured by E. M. Smith Co.

Fast Drilling

The drilling to 13,315 feet in 239 days, including 44 days lost because of mechanical trouble, is a tribute to skillful work by the drilling crews and careful supervision of A. H. Bell, general superintendent, and other members of field and geological departments. The attainment also reflects a high standard for the equipment used, especially since the going was hard at times and the temperature in the bottom of the hole was above the 255 degrees recorded at 12,879 feet.

Because of this record it may be interesting to recall other deep California wells. In 1920 Standard Oil Co. officials were congratulating themselves on reaching 6,240 feet in No. 1 Packard, in the Elk Hills field which required over eight months. Continental Oil Co. reached the bottom of its deep hole below 13,000 feet in less time, despite the fact coring began at 6,912 feet and continued at regular intervals down to the bottom. No. 1 Packard of Standard Oil Co. received the benefit of the most efficient drilling methods known at that time and the 6,240 feet represented the deepest well in California then. Subsequently Standard Oil Co. reached 6,602 feet in its initial Kettleman Hills wildcat drilled on top of the structure in Kings County, using both cable and rotary tools. This well, drilled in 1922, held the California record for a relatively short time. Europe's deepest well at that time was in Czuchow, Silesia, 7,345 feet. No. 1 Packard failed to secure commercial production and was abandoned.

Back in 1922

As late as 1922 it required 252 days for Standard Oil Co. drilling crews to reach 4,699 feet in No. 1 Brownrigg-Keller in the Santa Fe Springs field although only 94 days were spent in actual drilling as 158 days were spent in overcoming a difficult fishing job. The well was drilled with rotary equipment and the average depth averaged slightly above 50 feet per day. This well became the deepest producer in the state upon completion, flowing 500 bbls. of 34-gravity oil daily from 4,762 feet. The drilling foreman on this job was J. W. Rodeffer, and the drillers were T. F. (Big Boy) Northey, E. L. (Jumbo) Bowen, and H. G. Smith. Union Oil Co. No. 1-34 Kern County Land in the Rio Bravo field is at present the world's deepest producer with a current production of 2,550 bbls. of 38.1-gravity oil per day from 11,302 feet. It is believed probable the next completion in the Rio Bravo field will greatly exceed this depth as correlation work indicates a normal expectancy of 300 feet of Rio Bravo oil sand. Union took in only the upper 55 feet of productive formation as a precautionary measure. Barring mechanical trouble Superior Oil Co. No. 1 Wagner in section 35-28-25 should be the next completion at Rio Bravo as it has passed the 10,400-foot level.

Rotary drilling methods were introduced in California during 1905, but conditions on the West Coast necessitated decided changes in the original rig. The practice of drilling deeper than in the Texas and Gulf Coast areas required construction of heavier and more powerful machines. The original rotaries were fabricated out of cast iron and were exclusively chain-driven. Early California derricks, constructed of wood, were 64 feet tall and could handle from 12 to 15 tons weight from the crownblock. Superior Oil Co. during the past few years has used several 176-foot derricks and has a somewhat similar rig at Rio Bravo at present. Standard rigs at present approximate 122 feet and with extensions and reinforcements can sustain weights in excess of 200 tons.

Rio Bravo

Union Oil Co. discovery at Rio Bravo is about 2 miles north of the Rio Bravo school and approximately 20 miles northwest of Bakersfield in Kern County. It is well out from the foothills in a relatively flat area with little noticeable topographic relief other than a few low gentle swells that in general trend in a northwest-southeast direction. The area is completely covered by a thick mantle of alluvium and the little known of the subsurface geology has been gathered from the few scattered deep wells and from seismograph studies during the past few years. The broad gentle surface swells give some indication of the possible structure in the Pliocene, but until very recently practically nothing was known of the structural conditions in the Miocene. During the past two years great strides have been made in interpreting the Miocene structure in San Joaquin Basin and the seismograph has been a great aid to the geologist. Such discoveries as Ten Section and Greeley have added greatly to understanding of the Miocene structure in the flat part of the valley, but the importance of the recent discovery of Union Oil Co. cannot be overestimated since it establishes definitely the presence of prolific production at depths in excess of 11,000 feet, and suggests production can be obtained as deep as unaltered sedimentary rocks exist under favorable structural conditions.

The seismograph played an important part in Union's discovery, but topography led the Union

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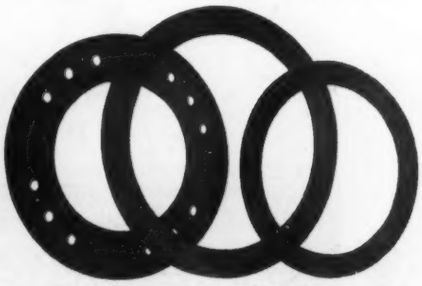

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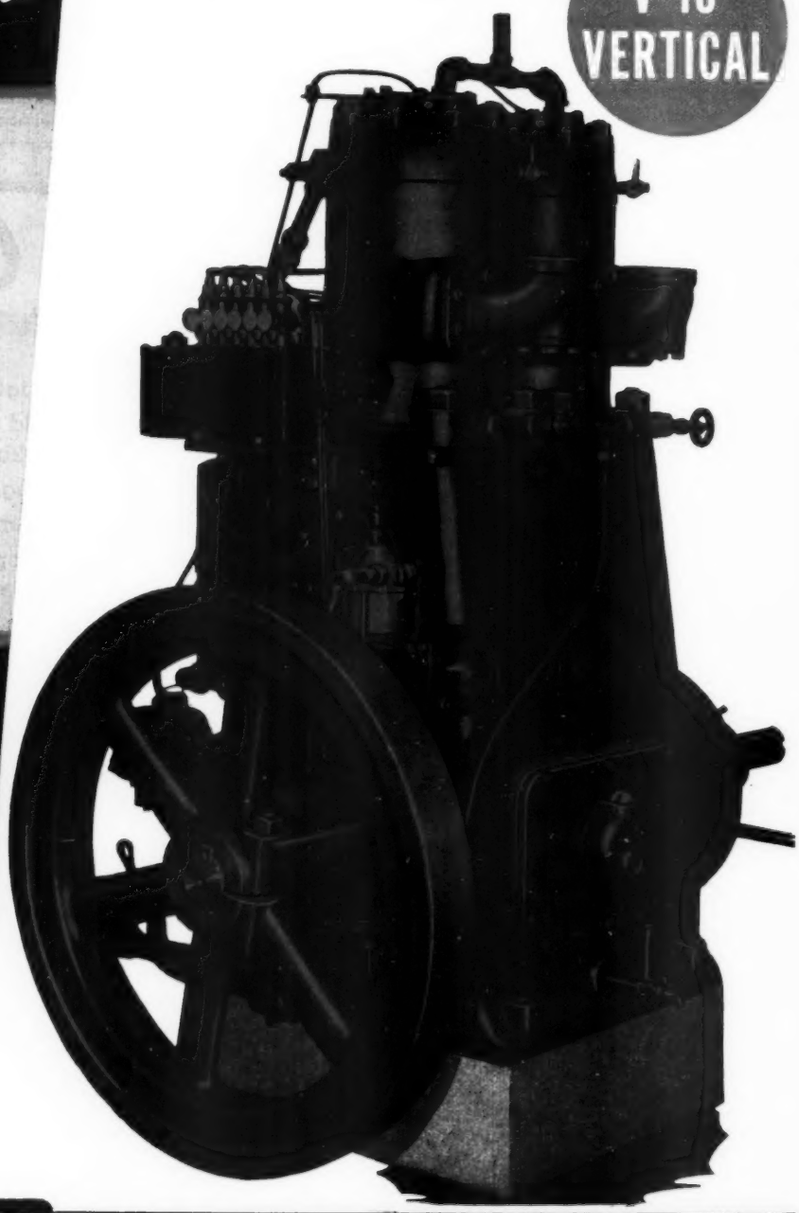

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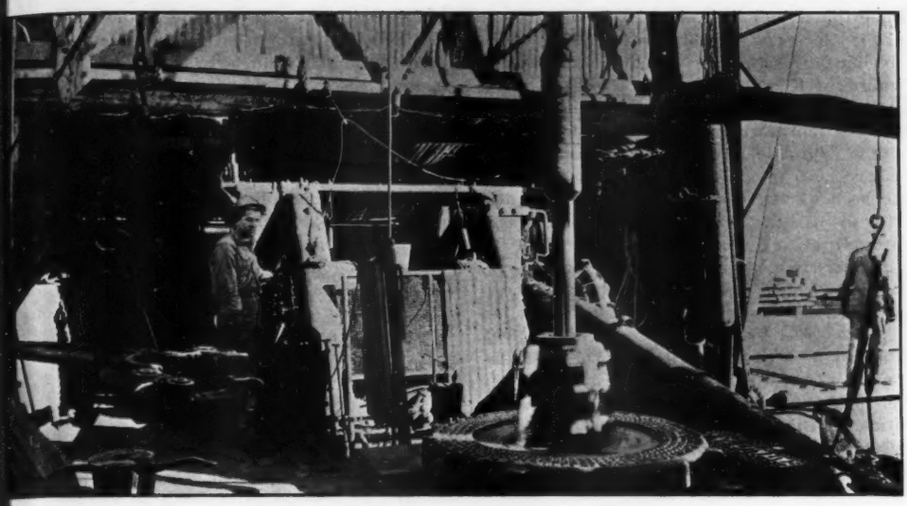


Making hole

eologists to suspect favorable structure here, and nuch of the land held by the company was aken along what appeared to be a general struc- ural trend. However, the actual location was nade from an interpretation of seismograph rec- rds, based on a horizon approximately equivalent o the top of the Greeley producing zone. The ocation of the test well was carefully chosen to onform to a definite spacing program, allowing ne well to 20 acres and staggering the locations n a manner similar to that now in use at Kettle- nan Hills. The actual location is 330 feet south nd 330 feet west of the NE cor SE section 34, ownship 28s, Range 25e, M.D.B.M. Elevation of he derrick floor is 336.8 feet. The well was spud- ed on March 29, 1937, and set 13⅜-inch surface asing at 1,143 feet. Ditch samples were taken ontinuously during the drilling of the upper part f the hole, and the top of the Mulinia zone was icked by this method at 3,793 feet. Coring, start- d at 4,500 feet, continued at intervals to 6,000 eet. Coring was continuous from 6,000 to 6,600 eet, and the well then drilled to 7,300 feet. From his point to the top of the Miocene cores were aken at fairly regular intervals. Top of the Mio- ene (Reef Ridge) was logged at 7,620 feet. Down o this point the only dips noted were practically lat and with the exception of a drilled interval rom 7,905-8,100 feet the entire interval from 7,- 00 to 9,000 feet was cored continuously.

Top of McLure Shale

Top of the McLure shale was picked up at ,000 feet. A few oil and gas shows were noted n the shale between 8,130 and 8,558 feet, and as and oil was often present on the ditch. Dips n this interval varied from 0 degrees to 7 de- rees, but averaged about 4 degrees. A few tringers of oil sand occurred immediately below ,559 feet and in one place there was 2 feet 3 nches in one body. These streaks gave an am- er-colored cut and had a kerosene odor. At 8,690 eet the top of what is apparently the equivalent f the Greeley sand was encountered. This con- sted of brownish siltstone with occasional thin nses of the fine sand. Oil occasionally showed the shale along bedding planes, or in the frac- res of the more cherty portions. A thin streak bentonite occurred at 8,901 feet. The top of e Lower Fruitvale was picked up at 8,902 feet. his interval consisted of brown to black shales ith occasional streaks of green bentonitic clay. few spots of oil were noted in the more cherty rts. Dips varied from 2 to 10 degrees, with e average around 4 to 6 degrees.

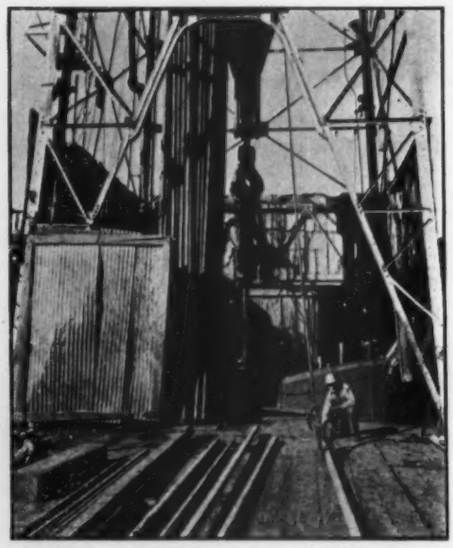
Top of the Valvulineria California zone (Round ountain silt) occurred in an uncored interval between 9,654 feet and 9,787 feet. The top of the zone, estimated at 9,575 feet, consisted of a hard, dark-brown shale with abundant foraminifera and some carbonaceous material. The top of the Valvulineria Robusta zone also occurred in an uncored interval between 9,795 feet and 9,889 feet, and the top was estimated at 9,800 feet. The zone consisted principally of poorly to well-bedded brown to black clay shale with occasional cherty shale and a very hard silty shale. In general, the observed dips were low in this interval, although in one or two places local dips as high as 12 degrees to 18 degrees were noted. A very hard sandstone that was very silty and apparently had very little porosity was encountered at 10,269 feet. A few slight straw-colored cuts were obtained in the sandy interval, which occurred from 10,260 feet to 10,318 feet. Another sand was encountered at 10,366 feet, and it is possible this sand is the equivalent of the Olcese sand first logged in the Round Mountain field. Approximately 65 feet of this sand occurred between 10,366 feet and 10,500 feet, with a fairly solid body of 58 feet at the top and two other streaks at 4 feet and 3 feet below. The sand was fine, brownish-gray, firm but friable oil sand, which gave good amber-colored cuts that had a fair petroleum odor. The top of the sand appeared rather silty and the cuts were fairly light, while the lower part of the sand gave better cuts and appeared to be somewhat more porous. While the possibilities of the sand were questioned, it still justified testing. A string of 6⅝-inch casing was cemented at 10,248 feet, and formation tests were made to ascertain both the shut-off and the possibilities of the sand. The results were not conclusive. They indicated the sand might not be productive in this location, but there is some reason to believe the test is not a fair indication of the capability of the sand, and it might be a source of some future production in this area. The sand, however, lacks the porosity and high saturation apparent in the deep sand. With the exception of one or two very thin streaks of oil-stained sand, the only other saturated sand found between this sand and the Rio Bravo sand was about 7 feet of medium to coarse oil sand in a core from 10,828 feet to 10,843 feet. This sand had a good odor and fair cuts.

Top of the Rio Bravo sand was encountered at 11,240 feet, and as soon as this sand was entered there was no doubt the well had encountered a promising zone. A total of 55 feet of solid oil sand was cored from 11,240 feet to 11,295 feet, and this sand was well washed and very porous. The top of the sand was gray, but had a good odor and gave a few light cuts. However, the cuts grew stronger with depth and the grayish sand took on a more brownish tinge. The bottom of this sand gave excellent dark-colored cuts and a very strong, sharp gasoline odor. One core, taken below the 55 feet of sand, consisted of 7 feet of gritty siltstone, and although this siltstone had practically no porosity, it showed considerable gas while still wet. It appeared probable there would be no danger in coring and that additional oil sand would be encountered. However, the 55 feet of sand looked so good it was thought advisable to make a test at this interval. It was decided to set an aluminum liner so that, if production was not satisfactory, the liner could be drilled up and the well deepened. The setting of this liner at this great depth presented a problem, but the difficulties were overcome by cementing a solid aluminum liner

J. H. Webb, T. M. Warden, W. H. Taggart, J. T. Campbell, drillers; second row: F. Linnenbrink, L. G. Liess, H. R. Colter, B. T. Smith, J. T. Grogan, R. D. Packard; third row: R. H. Crooks, O. Banks, P. Elder, J. E. Phillips, F. W. Banks, C. L. Leffler; fourth row: A. E. Norton, F. T. Woodward, J. O. Ponder, S. W. Jones, C. D. Patton

with the bottom at 11,220 feet. The bottom of the liner is 20 feet above the top of the sand, and the production test was made with the hole barefoot.

Union Oil Co. discovery well at Rio Bravo was completed on November 4, 1937, and flowed at a 2,400-bbl. rate per day through a 40/64-inch bean with 1,500 pounds on the tubing and 1,700 pounds on the casing. Gravity of the oil was 38.7 degrees with a cut of .1 per cent and the well was making



Preparing to add another joint of drill-pipe

about 2,000,000 feet of gas. The bean was reduced immediately to 8/64-inch, which in turn reduced the flow to 1,400 bbls. daily with 1,950 pounds on the tubing and 2,000 pounds on the casing, 39.6-gravity crude, and 1,260,000 feet of gas. The well remained shut in until pipeline connections could be made to the Rio Bravo pump station about 3½ miles south. The well never has been opened up, but some experimenting has been done with the bean, and, considering the high pressure and the small drop in pressure for a relatively large increase in production, it is certain the potential is far in excess of the 2,400-bbl. daily rate established on the initial test. The best estimates available seem to indicate that if opened up, the well should produce somewhere around 7,000 to 9,000 bbls. per day, but since it is now producing barefoot, it is probable it will not be opened to capacity. The Rio Bravo field may be and probably is along the same general structural trend as Greeley, but appears to be a definite and distinct structure. The main significance of the discovery is that a sand of such high porosity and good permeability is found at this depth. Tests on the cores from the 55-foot interval established definitely that commercial production can be obtained at great depth and that this sand will play an important part in development in the flat and alluvium-covered area in the southern part of the San Joaquin Valley.

Great Central Valley

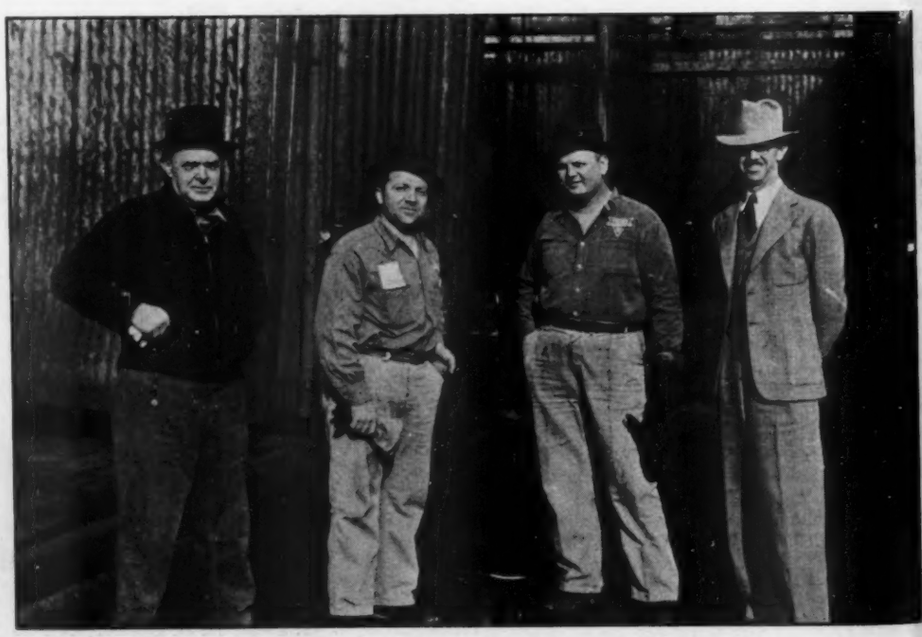
The Great Central Valley of California comprises an area of about 16,000 square miles and includes Sacramento Valley in the north and San Joaquin Valley in the south. The north end of the Sacramento Valley is at Redding in Shasta County, where it has an elevation of 600 feet and a width of approximately 10 miles. Extending southward, its width increases to 20 miles at Red Bluff, 40 miles at Willows and 45 miles at Suisun Bay, into which the Sacramento River discharges. The San Joaquin Valley, which is several times larger than Los Angeles Basin, has a width of about 30 miles at its northern extremity near Stockton and then increases in width as it extends southward until it reaches a maximum of 60 miles near Hanford in Kings County. At the base of the Tehachapi Mountains in the extreme southern end of Kern County, where the valley ends, it has a width of approximately 36 miles and an elevation of about 1,000 feet. Several large dry gas fields have been discovered in the Sacramento Valley during the past few years while a number of large and small oil fields have been discovered in the southern end of San Joaquin Basin in Kern County. The most recent of these principal oil discoveries in southern San Joaquin Basin include Ten Section field, discovered by Shell Oil Co.; Greeley field, discovered by Standard Oil Co.; Canal field, discovered by Ohio Oil Co.; and Rio Bravo field, discovered by Union Oil Co. The Wasco area, where Continental Oil Co. has passed 13,000 feet in its wildcat, is about 18 miles northwest of Bakersfield and in about the center of San Joaquin Basin.

The Sierra Nevada Mountain range is the dominating physical feature of California, as it forms a great single range from the base of the Lassen Peak range southward to Tejon Pass in northern Los Angeles County. On the western side it slopes gently up from the great valley to its crest and then drops off abruptly to the desert on its eastern side. In its northern portions it reaches an altitude of approximately 10,000 feet and southward it rises to its greatest height in Mount Whitney which has an elevation of 14,501 feet. In its northern and western part there are large areas of altered sedimentary and igneous rocks, which are highly mineralized. The mountain ranges are characterized by two major faults, the San Andreas fault, which lies in the Coast Range and extends from Cape Mendocino in Humbolt County to the Colorado desert, a distance of 600 miles, and the great fault, which marks the eastern base of the Sierra Nevada Mountains and along which the great Sierra Range was uplifted.

The general structure of San Joaquin Valley is that of a great syncline lying between the Sierra Nevada fault block in the east and the anticlinorium of the Coast Range mountains on the west. Within this syncline, however, there is a series of anticlinal folds which are marked on the surface in most cases by low rolling hills in addition to a number of buried structures. The hills are found mainly along the western side of the valley and for the most part project obliquely out into the valley from the main body of the coast ranges. In some cases, however, these structures lie out in the center of the valley floor and run parallel to the coast ranges, such as Los Hills and Elk Hills. All visible structures in San Joaquin Basin have been explored and either proved or disproved from a production standpoint and it is now necessary to prospect for hidden structures. General application of geophysical methods employing the reflection seismograph method has become especially successful and this method is responsible for discovery of new oil fields at Ten Section, Greeley, Rio Bravo, Canal, Canfield Ranch, and Mountain View, in addition to several gas fields in the San Francisco Bay region.

Ten Section Field

The Ten Section field, first of the discoveries to be made out in the center of San Joaquin Basin, followed by discoveries of fields at Greeley, Rio Bravo, Canal, and Canfield Ranch in the order named, is about 10 miles southwest of Bakersfield in Kern County. The productive area is on the very gently rolling floor of the San Joaquin Basin, although there is no surface evidence of the existence of structure. This lack of surface evidence of structure is likewise true of Canal, Greeley, and Canfield Ranch, but there is a slight surface indication of a buried structure in the Rio Bravo field. As a matter of fact Union Oil Co. drilled a wildcat in the Rio Bravo area a number of years ago, but did not carry the hole deep enough. The Ten Section structure is a gently folded anticlinal dome and development work since discovery has revealed the existence of a major cross fault which might be the result of a deflection of the southern end of the Ten Section field to form the Canfield Ranch accumulation. The Ten Section field cross-fault drops the southeast nose of the structure about 200 feet with reference to the northwest portion. Regionally the Ten Section field occurs as a fold in the deeper beds of the valley floor. Immediately below the surface alluvium there are approximately 900 feet of loosely consolidated, fresh-water sands and gravels with occasional thin layers of clays and sandy silts. These beds represent the Kern River series of Upper Pliocene and directly below them oc-



John Grier, drilling foreman; L. J. Hopkins, tool pusher in charge; Jim Craig, tool pusher, and A. H. Bell, general superintendent

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LOCATION . . . . . WASCO, CALIFORNIA
TOTAL RUNNING TIME . . . 10 HRS. 5 MIN.
TIME REQUIRED FOR CHANGING BLOCKS and OTHER DELAYS . . . 1 HR. 45 MIN.
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8 HRS. 20 MIN.
On the Wasco Well—Standard Seamless "Extreme Line" Casing made drilling history when 11,572 feet of 30-pound, 7-inch pipe was run in 8½ hours with a high run of 1790 feet in one hour!
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REGAN CROWN BLOCK
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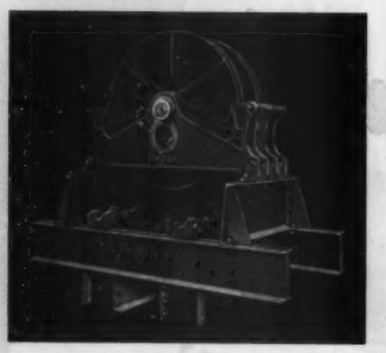
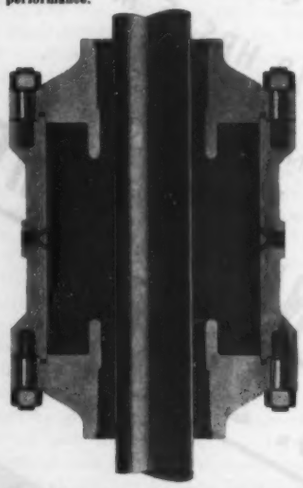


In congratulating the personnel of Continental Oil Company responsible for achieving the World's record depth in oil well drilling, it is with pardonable pride that we point to the Regan Equipment which played a part in making this possible.

The Regan 6-Sheave Type B Crown Block had already seen service on other wells before being used on K.C.L. A-2. This Block, orginally designed for 200 tons safe load capacity, speaks well for the materials and workmanship built into it to provide the strength and factor of safety necessary to assure such performance.



The Regan Type K Blowout Preventer, provided a means of instantaneous closure around pipe or kelly in the event of a threatened blowout, while the Santa Fe Casing Head provided a safe and economic means of suspending and tying the several strings of casing together.

Ask for Bulletin or see Composite Catalog.

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curs about 6,000 feet of Pliocene deposits, probably the equivalent to the Ethegoin formation. The Mulinia zone occurs at depths ranging from 3,950 feet to 4,050 feet. The uppermost portion of the Miocene is represented by the usual brown

Riffle box for de-gassing mud

shale, which is about 900 feet thick. The Stevens zone, from which production is secured, is directly beneath the brown shale and is also of Upper Miocene age. The Stevens sand is possibly the equivalent of the Fruitvale sand or the Fruitvale sand plus a portion of the Fruitvale shale member. The gas-oil ratio below the gas-cap in the Ten Section field is approximately 750 feet per barrel initially and drilling has indicated that wells in the vicinity of the gas-cap have a pronounced tendency to produce at increasingly greater gas-oil ratios. Bottom-hole pressures are taken immediately subsequent to completion and thereafter at regular intervals. Instead of dissipating the gas-cap this is being preserved by drilling down-structure with the thought that eventually edgewater encroachment will prevent the gas-cap from moving down-structure. Retention of the gas-cap will enhance future production of crude oil.

GENERALIZED LOG CONTINENTAL OIL CO. WELL NO. K.C.L. A2

Age—	Character—	Depth feet—	
Pleistocene	Soft sands and silts	0	2,820
Pliocene	Shale	2,820	4,380
	Bluish gray shales and silty shales	4,380	8,440
Miocene	Grayish brown shales	8,440	9,527
	Cherty brown shales showings of oil and gas	9,527	9,620
	Hard brown shales	9,620	11,581
	Hard sand	11,581	12,175
	Sands and hard brown shales	12,175	12,715
	Oil showing at 12,600		
	Hard dark brown shale	12,715	13,110
	Hard dark brown shale, few thin streaks hard sand	13,110	13,130
	Oil showing at 13,130 (kerosene odor)		
	Hard sand and brown shale	13,191	13,289
	Silty shale	13,289	13,312
	(Now coring)	13,312	

Geological Data

The principal formations exposed in San Joaquin Basin consist of about 20,000 feet of unaltered sediments of Tertiary age ranging from the Eocene to late Pliocene and these are overlain by small thicknesses of recent Quaternary deposits. It is probable that during the greater portion of the Tertiary period the San Joaquin Basin was a great inland sea and that at least twice during this period great thicknesses of organic sediments were deposited which subsequently became the ultimate source of the greater part of the crude oil now being produced in the valley. Near the base of these formations is the Kreyenhagen shale of Oligocene age which consists of about 1,500 feet of pink diatomaceous shale and lying chiefly along the western side of the valley. The second deposit of organic shale of the Tertiary period is of Miocene age and consists of about 5,000 feet of diatomaceous shale belonging to the Monterey and Santa Margarita series. It occupies almost the entire southern end of San Joaquin Basin and has been found highly productive in several fields. In the North Belridge field deep drilling has proved the Wagonwheel zone of Oligocene age highly productive and in the Huffman section of the Kettleman North Dome field two deep wells have indicated production possibilities in a formation beneath present productive Temblor, which is believed to be Eocene in age. This tends to indicate a possibility that the underlying Cretaceous may prove to be the source beds, especially since the Cretaceous was found productive in the Coalinga field a number of years ago, and is composed principally of diatomaceous shale. The Cretaceous has also yielded several gas fields in the Sacramento Valley.

Other Deep Tests

Foreshadowing deep-well explorations that were to come, the Peoples Natural Gas Co., Pittsburgh, Pa., put down a hole 4 miles northwest of McDonald, Washington County, Pennsylvania, which in 1914 had reached a depth of 6,435 feet. The well, reported at the time to have been drilled

(Continued on Page 78)

DRILLING LINE RECORD—K.C.L.—A2

Line No.	Size	No. of lines	Number R. T.	Depth On	Depth Off	Total No. of feet	Ton miles
1	1⅛" x 2,500	8	44	0	10,437	10,437	5,794
2	1⅛" x 2,500	8	56	10,437	11,584	1,147	4,520
3	1⅛" x 2,500	8	7	11,584	11,584	....	886
*4	1⅛" x 2,500	8	40	11,505	11,583	78	3,419
5	1⅛" x 2,500	10	34	11,583	12,640	1,057	2,958
6	1⅛" x 2,500	10	..	12,640	.....	....	....

*Line used in running 11,573 feet 7-inch 30-pound casing.

BIT RECORD—K.C.L.—A2

(Bits used from surface to 11,584 feet)

Type No.	Size inches	No. used	Total footage	Total hours	Drlg. speed ft. per hr.	Av. ft. per bit	Total core recovery	Per cent recov.
1	20½	1	497	10	49 7	497	....	....
2	14¾	1	221	4	55.3	221	....	....
1	14¾	10	4,787	200	23 9	478 7	....	....
1	9⅞	1	29	4	7.3	29	....	....
3	9⅞	4	1,375	100	13.75	343.7	....	....
4	9⅞	6	1,061	202	5 3	176 9	....	....
5	9⅞	29	2,771	904	3.1	95 6	....	....
	Wire Line Cores							
6	9⅞	2-28	289	....	....	144 5	262	90.6
7	3½	14-67	554	....	....	39.5	341	61.5
	Bits Used From 11,584 Feet to 12,914 Feet							
8	6	3	15	15	1.0	5	Junk trap	
5	6	17	814	216	3.8	47.9	....	....
9	6	30	469	....	....	15.6	381.5	81.3
10	6	3	32	....	....	10.7	20.0	65.6

Total bits used from 0 to 12,914 feet ..... 72 (Includes one bit and two junk traps)
Total core heads and bits 0 to 12,914 feet 49

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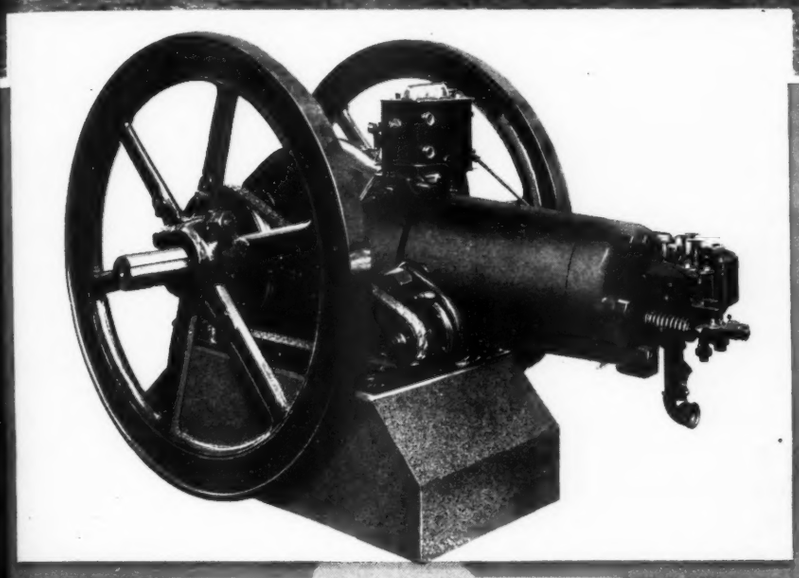
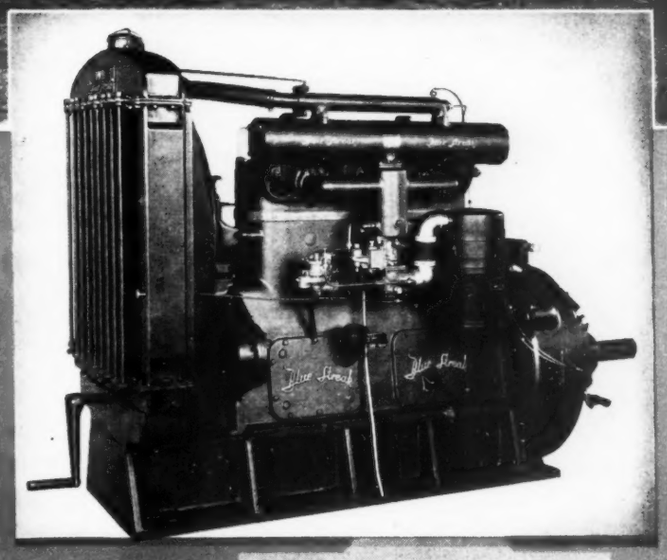
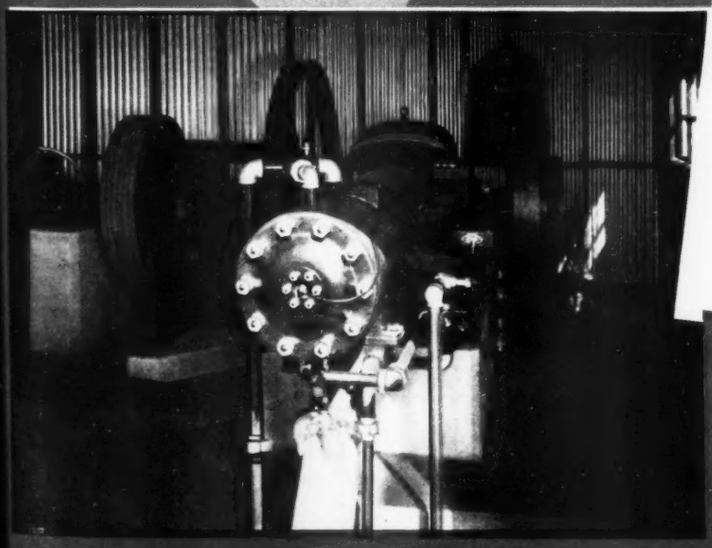


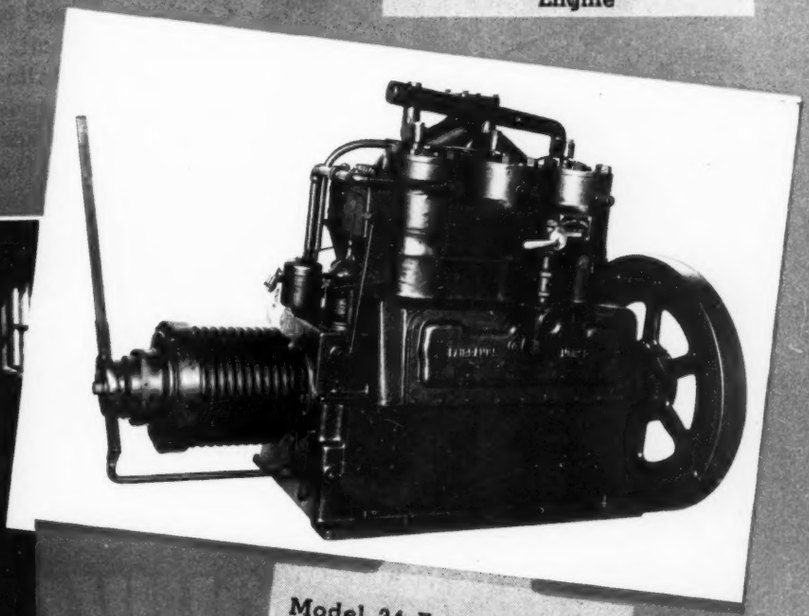
10 H.P. Fairbanks-Morse Type "Z" Engine with force-feed lubricator



Model N4B Climax Blue Streak Heavy Flyweel Engine

50 H.P. Fairbanks-Morse Single Cylinder Gas Engine driving Geared Power shown on opposite page





Model 34 Fairbanks-Morse Oil Well Pumping Engine

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"for scientific research," went to 7,248 feet and work on it was discontinued. It had its day as the "deepest well in the world drilled with cable tools."

The "deep-well era" may be said to have begun in 1922, when the Peoples Natural Gas Co. began a test on the Booth & Flinn property near Ligonier, in Westmoreland County, that state. It was drilled to a total depth of 7,756 feet, at which level it was discontinued in 1925. There were shows of gas at 7,428 feet and 7,442 feet. The three years consumed in making this hole were marked by cave-ins and fishing jobs. When the hole was abandoned it was the deepest ever drilled in this or any other country, and it was the only well of unusual depth that did not have to be abandoned with the tools or some other obstruction unrecoverable in the hole.

Other noteworthy deep wells had been drilled and abandoned in the meantime. A well of the Hope Natural Gas Co., Pittsburgh, in eastern Wood County, West Virginia, was abandoned in 1925 at slightly under 6,000 feet, having failed to reach the Clinton sand owing to drilling difficulties. Other records for that year include a well on Slaughter Creek, Kanawha County, West Virginia, which stopped at 5,595 feet in the Helderberg limestone. A well near Parsons, in Tucker County, stopped in supposed shale at 4,250 feet. Another, near Bridgeport, Harrison County, stopped in the Corniferous limestone at 7,386 feet. A well 7 miles southeast of Fairmont, W. Va., went to 7,579 feet and stopped in the Helderberg limestone. It had the distinction of being the world's deepest well for a while.

Wells in which the drill has gone more than 10,000 feet include the following:

Humble Oil & Refining Co. No. 1 Ellender, West Hackenberry, Louisiana, 12,165 feet. Producing at 11,620 feet.

Texas Co. No. 1 Bayou Sale, St. Mary Parish, Louisiana, 11,808 feet. Producing at 10,905 feet.

General Petroleum Corp. No. 1 Berry, Kern County, California, 11,377 feet. Awaiting production test.

Fohs Oil Co. No. 3 State, Lafourche Parish, Louisiana, 11,347 feet. Drilling.

Gulf Oil Corp. No. 1 Thomas, Grady County, Oklahoma, 10,553 feet. Drilling.

Shell Petroleum Corp. No. 1 Maco Stewart, Jeff Davis Parish, 10,460 feet. Gas well at 5,147 feet.

Harrison & Abercrombie No. 3 Bernard, Brazoria County, Texas, 10,427 feet. Producing at 10,303 feet.

Continental Oil Co. No. 1 C. C. Herbert, Vermilion Parish, Louisiana, 12,216 feet. Producing at 7,675 feet.

Stanolind Oil & Gas Co. No. 1 Stoval, Vermilion Parish, Louisiana, 12,133 feet. Abandoned.

Texas Co. No. 5 Rigolets, Jefferson Parish, Louisiana, 10,942 feet. Producing at 10,035 feet.

Shell Petroleum Corp. No. 1 Jarnigan, Jeff Davis Parish, 10,750 feet. Abandoned.

Texas Co. No. 1-B State, Vermilion Parish, Louisiana, 10,622 feet. Abandoned.

Humble Oil & Refining Co. No. 1 Nelson Thomas, Jeff Davis Parish, 10,583 feet. Abandoned.

Superior Oil Producing Co. No. 1 Duplanter, East Baton Rouge Parish, Louisiana, 10,360 feet. Abandoned.

Humble Oil & Refining Co. No. 1 Continental, Terrebonne Parish, Louisiana, 10,254 feet. Abandoned.

Shell Petroleum Corp. No. 1 Realty, Terrebonne Parish, 10,155 feet. Abandoned.

Pure Oil Co. No. 1 State, Cameron Parish, Louisiana, 10,146 feet. Abandoned.

Beatty, Bowles & Bersodi No. 1 Frank Truska, Brazoria County, Texas, 10,082 feet. Abandoned.

Texas Co. No. 1 Milling, Jefferson Parish, Louisiana, 10,040 feet. Producing at 10,020 feet.

Superior Oil Producing Co. No. 1-A Martinez, St. Landry Parish, Louisiana, 10,005 feet. Abandoned.

Denver Producing & Refining Co. No. 1 A-Dah-Noe, Caddo County, Oklahoma, uncompleted at 11,230 feet.

Creditul Minier No. 1 Chiturani, near Ploesti, Rumania, uncompleted at 11,160 feet.

North Kettleman Oil & Gas Co. No. 1 Lillis-Welsh, Kettleman North Dome, California, uncompleted at 10,994 feet.

Gulf Production Co. No. 103 McElroy, Upton County, Texas, uncompleted at 10,735 feet.

Penn-Mex Fuel Corp. No. 35 Jardin, Vera Cruz, Mexico, 10,585 feet. Nonproductive.

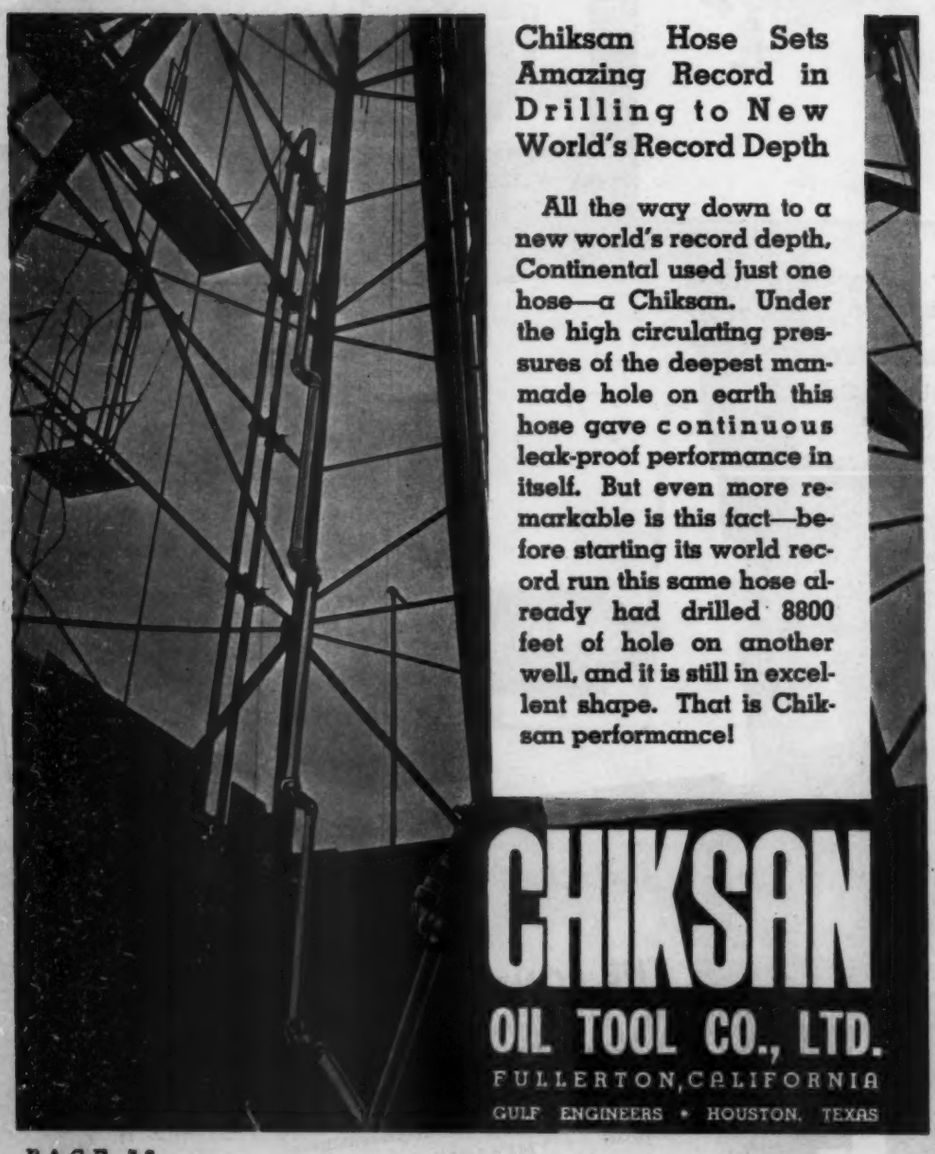
Western Gulf Oil Co. No. 1 Bradley, Santa Maria district, California, 10,296 feet. Nonproductive.

Kettleman North Dome Association No. 56-8-Q, Kettleman North Dome, California. Drilling below 10,080 feet.

Mid-Kansas Oil & Gas Co. and Ramsey Petroleum Corp. No. 6 Preston Culp, Caddo County, Oklahoma, 10,079½ feet. Nonproductive.

Chanslor-Canfield Midway Oil Co. No. 2-A Hobson, Ventura County, California, 10,030 feet. Plugged back.

OVER 21,800 FEET OF HOLE AND STILL GOING!



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The Use of Hydraulic Pumps in Mid-Continent Fields

By J. F. CRAWFORD
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This paper is a discussion of hydraulic pumping of oil wells in Mid-Continent fields and does not disclose a comparison of either construction, operation, or results obtained by any other type of equipment. (Comparative engineering data may be obtained if desired by reference to articles listed in the bibliography.) The paper is further restricted to the discussion of the application of hydraulic power to subsurface pumps only.

The practical application of large directly-applied forces immediately at the point of origin of work, which in pumping wells is within the fluid level in the well, was perhaps the primary reason for the development of the subsurface hydraulic pump. Other reasons contributing to this type of pump's development, and growing acceptance, could be cited as follows:

1. The inherent efficiency of power transmission by hydraulic means where it can be accomplished without adding to the already existing production hazards by the addition of clustered or suspended power tubes outside, but in conjunction with the production tubing, etc.

2. The application of power flowing in a continuous direction through stationary tubes, thereby eliminating vertical motion of the tubing within the casing. This contributes materially to the elimination of casing wear in crooked holes as well as to the reduction of emulsification of the produced oil by agitation while passing up through the tubing. This, in conjunction with the opportunity afforded for the introduction of treating compounds for "down hole treatment," offers the possibility of reduction in surface treating expense.

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3. A growing need for a pumping method that is not limited appreciably by increasing depths and one where, if possible, the same equipment can be used to pump efficiently and economically from either shallow or deep wells.

4. The providing of a method of operation that is adaptable to central power control conditions with its resulting savings in "standby" power, flexibility of operation, ability to "add to" or "take from" progressively, etc.

5. The possibilities presented of obtaining dependable operating data and information as to down hole conditions resulting from ability to accurately read stroke movement of a positive displacement pump.

6. The reduction, both in labor of installation and material, of non-salvageable investment.

To the best of the writer's knowledge there have been but two types of sub-surface hydraulic pumps tried in the Mid-Continent fields.

The first was tried in 1933 in the East Texas field by at least two companies. Its outstanding limitation seems to have been in the fact that it was not an insert type pump. Hence, because of its diameter, it had to be run on the outer string of tubing thereby making necessary the pulling of both strings of tubing in event of pump or other trouble.

Actual experimental data does not seem to be available as to the tests made but it is understood that considerable difficulty was experienced as a result of paraffin deposition within both the power string and the annular space between the two tubing strings. The paraffin, it seems, caused excessively high operating pressures and resulted

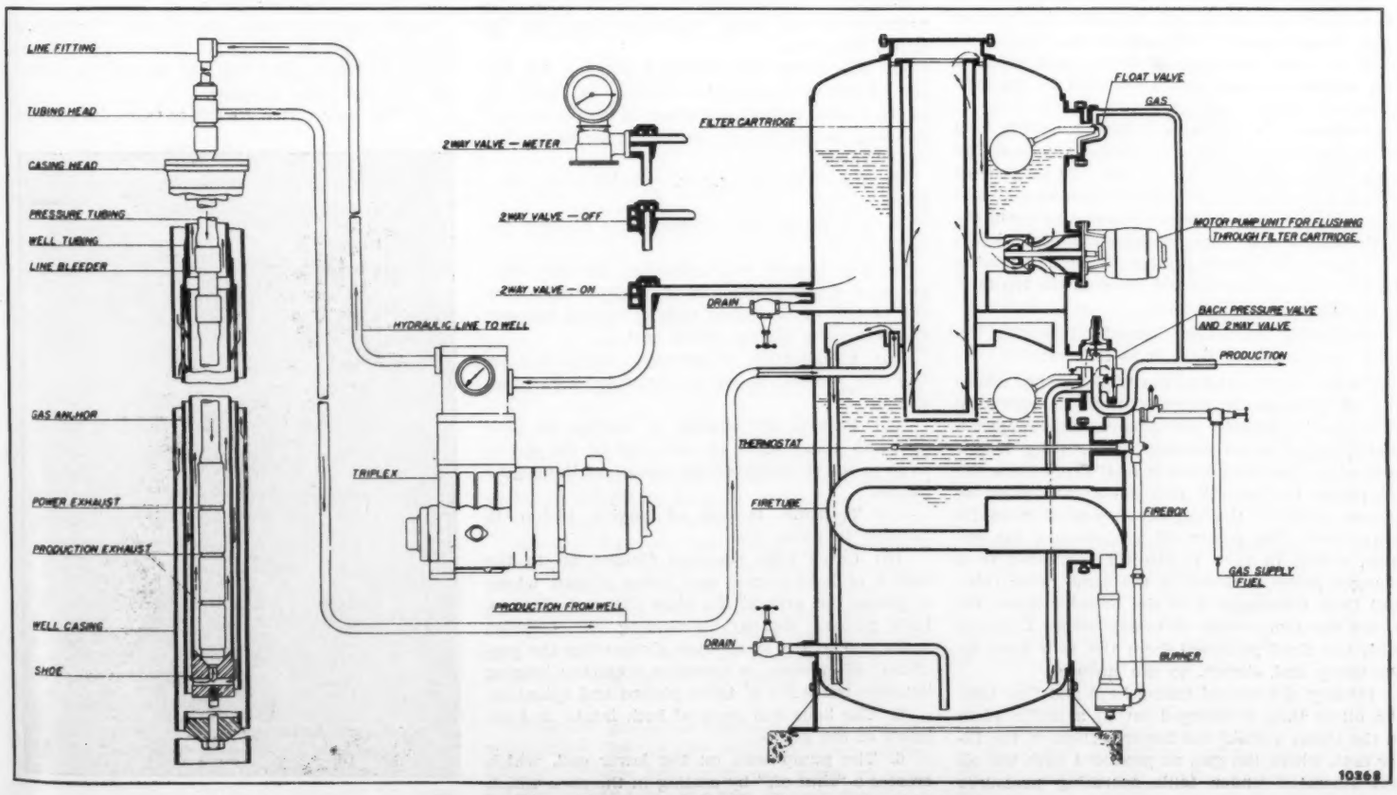

Fig. 1—Flow diagram of hydraulic pumping system

in too many pulling jobs although, while clear of paraffin, the pump is reported to have efficiently produced relatively large volumes.

The second pump, about which this paper mostly concerns itself, was introduced into the Oklahoma City field from California, in February, 1936. Since that time there have been some fifty installations made in that field (6,450 feet pumping depth), and five in the Foster pool of Ector County in West Texas (4,250 feet central power control). In addition, surface equipment is now in place for an eight-well centrally-controlled installation in the Fitts pool (4,200 feet) and for a well in the Moore field (7,300 feet), both of Oklahoma.

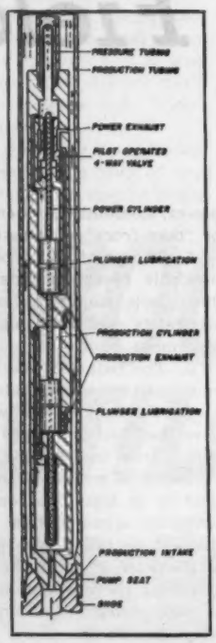

Fig. 2—Sectional diagram of hydraulic pump

A description of the equipment embodied in this second pump, together with details of construction and operation, capacity limitations, design problems and theory was presented in a paper at the sixteenth annual meeting of the A.P.I. at Los Angeles, Calif., in November, 1935, by C. J. Coberly. This paper was entitled "Hydraulic Power Applied to Oil Well Pumping" and was reprinted in the 1935 A.P.I. Year Book of Drilling and Production Practices. Therefore, the following paper will confine, as nearly as possible, its description and explanations of the equipment and its operation to as few words as possible and only present a working knowledge of the system, together with improvements and additions made since 1935, in order that more space can be devoted to the application and results obtained in the Mid-Continent fields.

Reference is made to Figure 1, which is a flow chart of the hydraulic pumping system. The unit on the right is a filter tank, the purpose of which is to filter the oil used as "power oil," and taken from the production stream. As shown, the tank (various sizes are furnished) is divided into two parts, the lower section being a receiving tank for the produced fluid whereas the top tank is a reservoir of filtered oil.

Beginning with this filtered oil in the top tank, the circuit of fluid is as follows:

To the suction end of the triplex pump where the oil pressure is stepped up to an operating pressure in pounds per square inch, approximately equal to an amount representing 40 per cent of the pumping head in feet. From there the oil passes to the well and down the center or power string to the engine suspended from its lower end. The power oil reciprocates the engine, which in turn is directly connected to a plunger pump enclosed in the same outer tube, and then discharges into the annular space between the two strings of tubing where it unites with the fluid produced from the well bore by the pump and, thence, to the surface.

By way of a special tubing head and flow line, the oil is then discharged on to a baffle plate in the upper part of the lower section of the filter tank where the gas, as produced with the oil and liberated under tank operating pressures (usually 30 to 50 pounds per square inch) is separated and accumulated in the gas area of both tank sections, as indicated.

The fluids, solids, B. S., etc., then pass to the bottom of the tank by way of a "drop" pipe from whence the production, including oil, water, sand, etc., is lead through a "riser" pipe to a back pressure valve and then discharged into the normal lease gathering system.

The oil that is to be used as power oil rises slowly (approximately 1½ inches per minute) by an internal heating unit where its temperature is raised to a point well above that where paraffin normally crystallizes out of the oil body and thence through a filter section (generally ceramic tubes in this area) introduced between the two tank sections as noted. Thence through, what are normally, stationary vanes of a small centrifugal pump, by way of a channel brought down from the top of the upper tank section, and to the reservoir of clean oil in the upper tank from which point this "oil circuit" description started.

The centrifugal pump, referred to, is provided in the circuit in order to periodically "back wash" the filters, thus cleaning them of accumulated sand, dirt, emulsion, etc. This is done by regularly and automatically contacting the 1½ hp. motor, which is used to power the centrifugal pump, thereby setting up a violent flow of oil in the opposite direction to normal flow through the filter tubes. This is made possible by the presence of the gas chambers or areas in both the upper and lower tank sections. The upper gas expands as oil is removed from the upper tank section, thereby maintaining as nearly as possible a uniform pressure on the suction end of the triplex pump, whereas the gas in the lower tank contracts and acts as a surge chamber for the "back wash" oil.

Surplus gas from both the upper and lower tank sections is discharged directly into the production lines, by means of the ball float and valve mechanism shown, without going through the back pressure valve.

Figure 2 is a sectional diagram of the sub-surface unit as run in on the bottom end of the power or so-called macaroni string. This consists primarily of six parts. Beginning from the top down, they are:

1. The 4-way pilot operated valve which has for its double function the delivery of power oil to the engine in such a manner as to create reciprocating motion and at the same time do so without "hydraulic knock."

2. The power, or engine, cylinder with power piston.

3. The production cylinder with plunger piston.

4. The hollow rod extending through both power and pump end into a "well" extension in the bottom of the pump body. This rod has several functions among which are:

(a) Equalization of pressures above and below the pistons, so as to eliminate unbalanced areas.

(b) Provide for change of position of pilot operated 4-way valve at each end of the stroke so as to set up reciprocating motion of the engine piston.

(c) Transmit motion of engine piston to plunger in pump end.

(d) Carry high pressure filtered oil to the center of both engine and pump pistons where it passes out around the close fits and rings of both pistons thereby lubricating the cylinder walls and at the same time eliminating the possibility of errosive or corrosive materials lodging between the walls of these pistons and cylinders.

5. The balls and seats of both intake and exhaust of the pump.

6. The pump seat, on the lower end, which creates a "shut off" by seating in the shoe which in turn is carried on the outer or production tubing string, as an integral part of the "gas anchor." A complete "shut off" is effected by means of:

(a) Wedging action.
(b) Close fits.
(c) Steel rings.
(d) Lead ring.

Flow of both power and produced oil through the pump assembly is as indicated, in the figure, by arrows.

Assembly of the sub-surface equipment in the hole is in the following order:

1. The outer or production string is run in with a gas anchor suspended from the lower end. (The O.D. of this anchor is approximately the same as the O.D. of the collars of the production string.) The purpose of the anchor is, as the name implies, to separate the gas from the oil and to provide a column of solid fluid to the pump intake. As noted above the pump seat is incorporated in the gas anchor.

2. At the surface the production string is "packed off" from the casing in the normal manner.

3. The insert pump is then introduced into the production string.

4. Immediately above the pump is placed a "surge" valve. This is a new development consisting mainly of an inverted ball and seat having for its purpose the elimination of "back flow" through the pump resulting from power waves set up by variations in fluid pressure or by other causes.

5. Above this but inside the power string is then run a fine meshed screen on the top end of a tube which provides for the screening, and settling out, of any mill scale, dirt, etc., which may have been left in the power string.

6. A joint of power tubing is then added, on the upper end of which is screwed a "bleeder." This "bleeder," provides a method for "bleeding" the power string when it is desired to pull the pump for any reason. It also provides a "shut off" at the lower end of the power string for testing the "efficiency" of the string prior to the beginning of pumping operations.

7. Immediately above the "bleeder," but again inside the power string, is introduced another screen and tube, like the one above the pump, and for the same purpose.

8. The power string extends from the bleeder

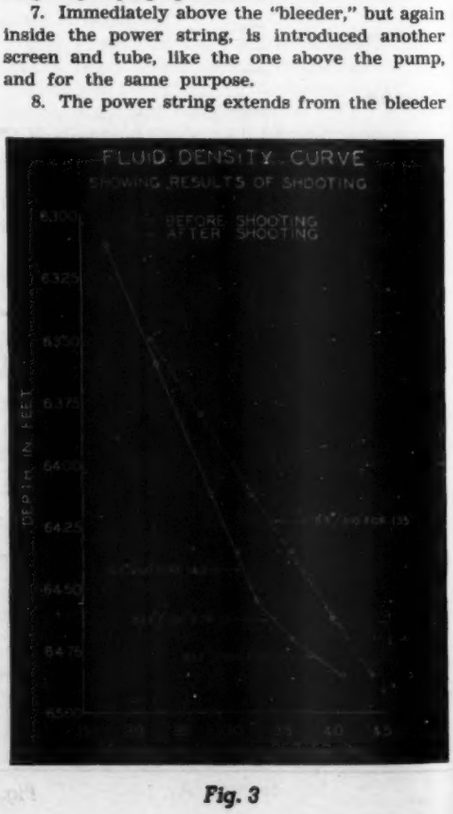

Fig. 3

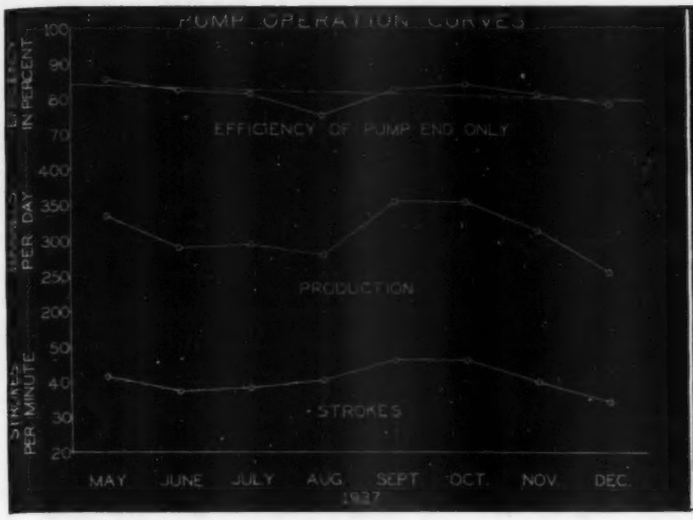

Fig. 4

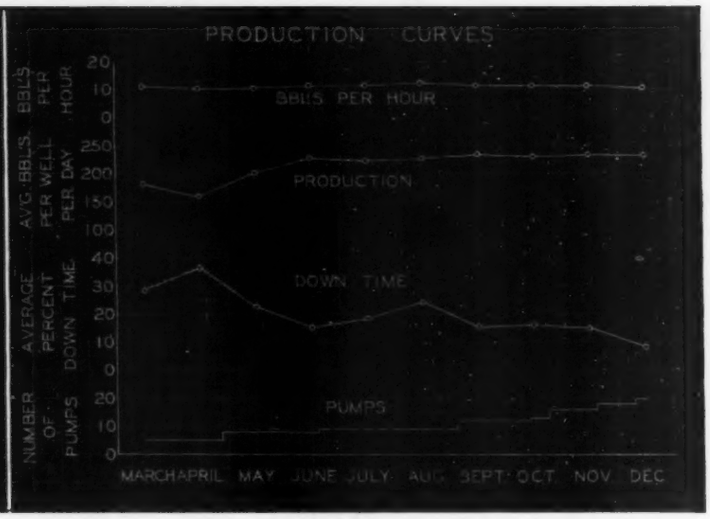

Fig. 5

to the surface where it is packed off inside the production string with a tubing head and is "topped" with a high pressure head or "tee" with flange connection on the side for connecting to the line from the power or triplex pump.

Some operators hang back the power tubing on so-called rod hangers, whereas others stand the 1¼-inch tubing back in the derrick by using two finger-boards.

Referring again to Figure 1, attention is called to a different method of hooking up the "single well" system than that illustrated. Where a considerable percentage of water is present in the produced fluid it is often found advisable to deliver the fluid from the well head to a settling or treating tank, then draining off "water free" oil from a storage or settling tank and stepping it up to required pressures, by means of an auxiliary pump, and thence delivering it to the filter tank. This is often found necessary due to the tendency of oil in the tubing column to by-pass the water, resulting in alternating slugs of oil and water being delivered to the surface and at times filling the filter tank with nothing but water and, hence, leaving no supply of oil for power purposes.

Auxiliary pumps, until recently, have been either 1½ or 2 hp. motored centrifugal pumps of about 80-foot head and 30 G/M capacity.

New Developments

1. Gas-gasoline engine driven triplexes. In order to take advantage, where desired, of gas-gasoline engines as prime movers early in the summer of 1937 the electric motors were removed from the triplexes and a 6-groove pulley substituted there for, with a gear train reducing its R.P.M. to the crank shaft of the triplex. This is available in different ratios and so as to provide for direct drive from the prime mover through flexible coupling or by means of belts.

Some of the advantages of this change may be cited as:

(a) Reduced power consumption charge, particularly where gas used is free.

(b) Greater flexibility and control of pump speed.

(c) Greater "out-put" of triplex power made possible by virtue of greater R.P.M. speed and reduced direct bearing pressure resulting from possible use, accordingly, of smaller diameter plungers and liners.

Mechanical Flushing Units

2. Furthering the idea of thoroughly mechanizing the system, a recent development has been the substitution of mechanical flushing units for the electric drive—centrifugal pump system heretofore an integral part of the upper tank. This has been accomplished by taking the oil from the channel leading to the electric driven centrifugal flushing unit through tubes to the outside of the tank, thence down to a centrifugal pump, at the base of the tank, belt powered from the driven pulley on the triplex where its pressure is boosted upwards of 20 pounds and then discharged into the "top tank" section.

A mechanical "cycle controller," actuated by a tripping action effected by the vertical motion of the triplex plunger next to the prime mover, is attached to the triplex which periodically permits high pressure oil, from the triplex discharge, to pass through the controller and thence to a large valve in the upper tank, located in the line from the filter tubes to the mechanical centrifugal flushing pump. This high pressure oil forces open the valve permitting the oil in the upper tank to back wash through the filters to the lower pressure of the bottom tank. Of course, this oil also has access to the centrifugal pump intake but there is an available surplus of both pressure and oil.

Mechanical Driven Auxiliary Pump

3. Driven by the same belt and shaft as the mechanical flushing pump is now furnished an auxiliary gear type pump. This replaces the electric motored centrifugal pump used to "charge" the system from the stock tanks.

Internal Water Heater

4. Until the advent of this gas engine drive, heating of the oil for filtration purposes was accomplished by either an internal direct gas combustion flue type heater, as illustrated in Figure 1, or by an external heater wherein the oil passed through coils submerged in steam and water within the heater which in turn was heated by burned gases, from low pressure type thermostatically controlled burners, passing upward through flues within the water chamber.

Recently, however, the internal gas heater has been replaced by a multiple tube heat exchanger. Water, heated by passing through both the engine cylinder and exhaust manifold water jackets, is transferred through this heat exchanger thus heating the oil to be filtered and at the same time cooling the circulating water for recycling.

A further perfection has been to circulate the water, after leaving the manifold water jacket, through another heat exchanger, made by passing the engine exhaust gases through flues in a water jacket made from a section of 6⅝-inch casing about 4 feet long, thence to the heat exchanger inside the filter tank. This latter step reduces the temperature of the engine exhaust gases from upwards of 550° F. to about 220 degrees, thereby creating a virtually fire-proof system. Close connection of triplex and engine is thus made practical from a fire hazard standpoint and both units can be enclosed within a building and generated heat further conserved.

A thermostat, provided in the water system, allows water to pass through the radiator, in event it becomes too hot, and thus "air locking" of the water pump is guarded against. In addition to this "pocketing" is reduced by means of air releases provided at this high point of the water system between engine and filter tank.

Surge Valve

5. Wilcox sand production in the Oklahoma City field has been very "sandy" particularly so in the newer development in the north end, where the major portion of these hydraulic pumps have been located. It was early noted that, although filtering conditions appeared to be normal, the engine end of the pumps when shut down and pulled, for any reason whatsoever, generally contained Wilcox sand and dirt from the produced oil indicating a back wash of dirty oil through the engine although the pressure on the power oil at the surface was apparently greater at all times than on the produced oil. It was argued, however, that a reduction in pressure on the power oil due to variation in prime mover speed, shut down, etc., might set up power impulses or waves acting back and forth through the bottom-hole engine.

To overcome this, therefore, an inverted ball and seat was designed and introduced into the power oil string immediately above the pump. Only one of these valves has been pulled to date but the condition of the seat indicated this surging action to be severe; hence, the valve undoubtedly fills an urgent need.

Operating Experiences—Oklahoma City

Wells under consideration from the standpoint of hydraulic pumping in the Oklahoma City field are wells produced from approximately 125 feet of Wilcox Sand, having an average total depth of 6,450 feet. The character of this sand has given it a very high degree of permeability, thus affording a high rate of fluid entry with the existing low bottom-hole pressures.

Production history of this field shows a very normal flowing life, during which time large quantities of sand were produced. During this period the operators were confronted with the

problem of keeping well conditions intact, which at times, was quite difficult.

Following the normal maximum flowing period, gas-lift was utilized for some time, but the wells gradually declined to a point where it became necessary to install some type of mechanical lift. This change came at a point where the bottom-hole pressures had dropped to below 100 pounds per square inch.

With the entrance of pumping, came several perplexing problems, which gave the operators in this field considerable difficulty. The two most severe conditions may be classified under two main divisions, viz., sand and light fluid.

Sand and Light Fluid

Well conditions were perhaps the most serious problems in the pumping of the Oklahoma City field. In the North Oklahoma City field, at least 60 per cent of the down time of the hydraulic pump can be attributed to sand and light fluid (50 per cent for sand and 10 per cent for light fluid). Several different designs of slotted and screened liners were tried but with little success. Liners with sufficient openings would not hold back the sand and screened liners sealed off the production.

By the use of bottom-hole recording pressure gauges, it was found that the fluid existing in the well bore was in many cases simply "foam," whose density was about half that of solid oil. Figure 3 shows a density and fluid column in a typical Oklahoma City well before it was shot. Here the fluid weight was 16.3 pounds per 100 feet, while solid oil of 38° A.P.I. has a weight of approximately 36 pounds per 100 feet. As a result volumetric efficiency of the pumps was greatly reduced due to the necessity of handling, by comparison, relatively large volumes of gas.

Various size and type of gas anchors were tried in an effort to separate the oil and gas before the mixture entered the pump, but this too was generally unsuccessful.

The last and most beneficial move was that of shooting. The wells were shot with a comparatively light shot of from 80 to 200 quarts of solidified nitroglycerine. The quantity of sand removed following the shot was surprising, and it is the common opinion that this shooting resulted in large entrance cavities at the base of the well bore. This served, not only as a large pocket through which fluid movement was slow and allowed floating sand to be dropped out, but it also afforded a natural gas anchor which could not be duplicated mechanically.

Referring back to Figure 3, the left hand curve indicates the bottom-hole pressures after shooting the well. Here we find that the weight of the lower 15 feet, located 2 feet off bottom, has increased to 33.3 pounds per 100 feet, or within a few pounds of solid fluid. This increase in fluid weight was brought about by the large cavity allowing the solution gas to separate. Naturally the operator set the pump as close to bottom as possible to insure submergence of the suction of the pump in the solid fluid. It should also be noted that in spacing the pump, this close to bottom, the sand trouble has been at a maximum, thus showing why such a high per cent of down time has been caused from sand.

Paraffin

Paraffin has been a decided problem in the hydraulic pumping of the Oklahoma City field. When down time records are considered, it will be found that not more than 10 per cent of the total down time has been directly caused by paraffin accumulation revealed by the operating pressure of the power oil.

Two methods have been used to combat this problem, viz., chemical and mechanical. The chemical has been given the majority of the consideration, but has proven to be of little benefit to date. Mechanical scrapers are now being run and the records now available indicate that we can expect a decrease in the down time due to paraffin as a result of the use of these scrapers. However, this is still in the experimental stage.

The scraper consists of tubular sections with spiral cutting edges and weighted with a long slender rod to aid in lowering after pulling. The scraper is run on a .066-pound steel measuring line and when it is not being run is allowed to hang on the line well below the paraffin level. Periodically the scraper is pulled and again lowered back into the well. During this operation the well is not slowed down or stopped, as the line is pulled through a stuffing box on the top of the hydraulic tubing. The paraffin that is secured passes through the hollow scrapers and through the pump as it is undoubtedly in solution at bottom-hole temperatures.

TABLE 1—SUMMARY OF PUMP ANALYSIS ON 22 WELLS IN OKLAHOMA CITY FIELD

Well Number	Number of Kobe pumps	Prod. by Kobe pumps	Average prod. per pump	Pumps that did not produce	pumps 0-500 bbls.	pumps 500-2,000 bbls.	pumps 2,000 to 5,000 bbls.	Pumps over 5,000 bbls.
1	16	15,078	942	8	1	4	3	0
2	9	50,008	5,556	1	1	2	0	5
3	14	31,611	2,258	6	4	0	2	2
4	1	2,436	2,436	0	0	0	1	0
5	5	15,426	3,085	2	0	1	1	1
6	6	10,122	2,531	4	0	1	0	1
7	4	90,226	22,558	1	0	0	1	2
8	3	39,626	13,208	0	1	0	0	2
9	22	21,401	973	7	4	8	3	0
10	20	22,710	1,136	7	4	5	3	1
11	8	114,157	14,270	0	1	3	0	4
12	8	20,979	2,622	4	2	1	0	1
13	3	6,654	2,218	1	1	0	0	1
14	9	5,183	576	7	1	0	0	1
15	3	14,267	4,756	0	1	0	0	2
16	9	15,648	1,739	3	1	1	4	0
17	3	18,921	6,307	1	0	0	0	2
18	21	130,181	6,199	8	0	3	4	6
19	5	29,736	5,947	0	1	1	1	2
20	3	25,038	8,346	1	0	0	0	2
21	21	27,304	1,300	4	7	6	3	1
22	26	72,779	2,799	13	0	0	5	8
Totals	219	776,791	3,547	78	30	36	31	44
Per cent				35.6	13.7	16.4	14.2	20.1

TABLE 2—PUMPS PULLED IN OKLAHOMA CITY FIELD BY MONTHS

	1937 June	July	August	Sept.	Oct.	Nov.	Dec.	1938 January
Number wells operated	34	34	41	42	49	50	50	51
Pumps per month	69	52	75	82	84	36	64	41
Pumps per well per month	2.03	1.53	1.83	1.95	1.72	1.44	1.28	.803

Efficiency

In an effort to determine the over-all efficiency of the present hydraulic pumps, several wells have been taken into consideration with the following results:

Using the total number of barrels produced and the total amount of energy required to operate all surface equipment, an average figure gave an over-all efficiency of 60 per cent. These efficiencies are based on wells that have not been subject to paraffin accumulation in the tubing strings. Good operating wells have been found to have an over-all efficiency of as low as 42 per cent, due to paraffin accumulation without affecting the production. These calculations are based on electric drives, because of the simplicity and accuracy in measuring the actual input energy. There are a large number of gas engine drives now in use in Oklahoma City but test data of this nature is not available at the present time. These calculations were made on wells pumping from 6,450 feet, and represent the efficiency that may be expected from any other field that is operating under similar conditions of depth and bottom-hole characteristics.

Pumps in other fields operating at a lesser depth should show a slightly higher efficiency, because of the fact that the only major difference in operation is the friction lost in the tubing.

One pump in the Oklahoma City field that has operated for a period of better than eight months showed a beginning efficiency of the pump end of only 84 per cent and dropped to 79.5 per cent over this 8-months period. As can be seen from Figure 4, the maximum efficiency during this period was encountered at a relatively high pump speed and only a slight decrease in efficiency occurred when the pump was slowed down due to proration requirements on the well. In the writer's opinion, the loss in efficiency of 4.5 per cent is due largely to the pump wear and not to changing well conditions. This, as the writer sees it, points out very clearly what can be expected from pumps operating under ideal well conditions; viz., solid fluid with a relatively high fluid level, and the absence of floating sand. As can also be seen from this curve, the average barrels per day over the 8-month period was 304.8, with an average down time of not more than 2.7 per cent.

During the month of August, considerable work was done on the surface equipment of this installation, which consisted of speeding up the pump in an effort to establish the maximum operating speed of the bottom-hole pump. During this test the efficiency of the pump was disturbed, as can be seen from the curve in Figure 4. This disturbance was probably due to an increase in the amount of free gas in the bottom of the hole, thus lightening the density of the fluid which resulted in inefficient pump loading. It will be noticed from the curve that during the following month of September the pump was put back to normal operating speeds and the efficiency and average barrels per day righted themselves back to normal.

Production and Down Time

In an attempt to draw a picture over some period of time by taking into consideration a group of wells throughout their entire life while produced by hydraulic pumps, the accompanying Figure 5 is presented. It will be noticed that the lower curve gives the number of installations at all times and is a gradual increase as the wells have been equipped with the hydraulic pump.

The down curve is given in per cent and takes into consideration all down time including not only that which may be attributed to failures of the pump but also all down time resulting from well conditions such as cleaning out, shooting, the running and pulling of liners, deepening, etc.

It will be immediately noticed that this curve has a decided downward trend, justified by decrease in mechanical failures and marked improvement in well conditions.

The following is a break of the down time in per cent of the total:

	Per cent
Well conditioning and light fluid	60
Paraffin	10
Mechanical	15
Dirt in power oil and tubing	10
Miscellaneous	5

(Continued on Page 225)

Petroleum Oils as Insecticides

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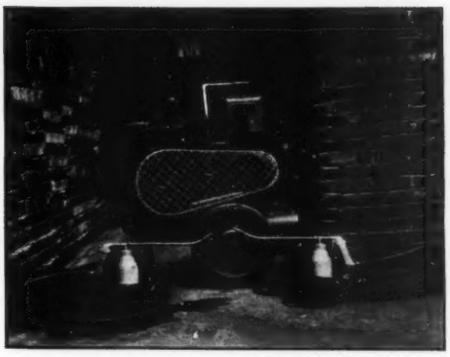

Figure 1

Petroleum oils are used in all branches of applied entomology, because, as contact insecticides, they are effective against the two types of insect, those which pierce the surface of their food and suck it up, also against those which bite their food.

The various branches of applied entomology can be grouped under the following headings:

1. Horticultural, agricultural and glass-house entomology.
2. Household and industrial entomology.
3. Medical and veterinary entomology.

The types of oil, the form in which they are used and their method of application, differ widely in each of these three fields.

Horticulture and Agriculture

The oil is usually applied, in horticultural and agricultural practice, as an emulsion of oil in water. The emulsion is rendered more or less stable by the presence of an emulsifier. Oils in an atomized form, not in an emulsion with water, have been used from time to time and experiments with this method are still in progress.

There are two factors to be considered when oils are used as plant sprays; the effect on the insect and the effect on the plant. The aim has always been to kill the insect without damaging the plant and it is possible, by using certain types of oil, to obtain a maximum insecticidal effect with a minimum phytocidal effect. A discussion of the present state of our knowledge of the factors influencing these effects is given by Martin, 1935, and by Farrar, 1936. A considerable amount of work has yet to be done on this subject.

Where there is a variation in climate, the plants will stand much more drastic treatment in the winter, when they are dormant, than in the summer when they are growing. Two general types of oil spray have therefore been developed, one as a winter wash to destroy the over wintering stages of the insect, and one as a summer wash.

According to Martin a winter oil should satisfy the following criteria:

Sp. gr.: (60° F.) 0.86-0.92.

Boiling range: At least 90 per cent by volume to distill above 315° C.; at least 50 per cent by volume to distill above 350° C.; at least 20 per cent by volume to distil above 380° C.

Viscosity Redwood 1 at 70° F. not less than 125 seconds and not more than 500 seconds.

Unsulfonated residue not less than 60 per cent by volume.

The oil should yield 100 per cent neutral oils and be free from alkali.

The following specifications are given as a guide for a summer oil:

Sp. gr.: (60° F.) 0.86-0.92.

Boiling range: Not less than 90 per cent of the oil to distill above 300° C.; not less than 10 per cent below 330° C.; not less than 50 per cent to distill above 340° C. and below 365° C.; not less than 20 per cent to distill above 370° C. and not less than 80 per cent below 390° C., all percentages by volume.

Viscosity Redwood 1 at 70° F. approximately 75 seconds minimum (equivalent approximately to 60 seconds Say. at 100° F.) and 150 seconds maximum (equivalent approximately to 110-120 seconds Say. at 100° F.).

Unsulfonated residue not less than 90 per cent.

It is not possible to make a useful statement on the other chemical and physical properties of the oil because there is not sufficient evidence of their effect.

The effects of the properties of the oil, on which these specifications are drawn up, are thought to be as follows: The unsulfonated compounds of the oil cause acute injury to the plant and it is therefore necessary that only a small percentage of them should be present. Their effect on the insect is not yet fully understood. Increase in the boiling range of a refined oil, such as it is necessary to use, increases the toxicity of the oil to the insect, but oils of low volatility and high viscosity tend to set up physiological disturbances in the plant and if used often may have a cumulative deleterious effect. It is therefore necessary to adjust the boiling range and the viscosity so that the oil will kill the insect without setting up serious disturbances in the plant.

When the oil is in an emulsion in water, the droplet size of the emulsion and the nature of the emulsifier are important factors affecting the toxicity to the insect and the damage to the plant. It is the general opinion that it is best to use a quick breaking emulsion of large droplet size, if the droplets are evenly distributed throughout the spray fluid. The emulsifier may be a contributory cause of damage to the plant and Farrar, 1936, states that oil emulsions made with soap are generally toxic to foliage, irrespective of the saturation or viscosity of the oil.

Emulsions of oils for insecticides are either miscible oils or stock emulsions.

Miscible oils are solutions of the emulsifier in the oil. These are generally stable in storage, but are unsuitable for abnormally hard waters. The two solution type of miscible oil consists of a solution of oil in oleic acid or other oil soluble acids giving surface active salts; dilute alkali is added to obtain an emulsion. Single solution miscible oils are obtained by adding a mutual solvent, such as cresols, to the oil and emulsifier. Stock emulsions are concentrated emulsions of the oil in a little water and emulsifier, which can be diluted. Examples of emulsifiers used for this purpose are the soaps, casein and sulfite lye.

Sprays, in which oil alone is the toxic agent, are employed against a variety of insects. Two of the most important instances of their use are against the "codlin moth" *Cydia (Carpocapsa) pomonella* on fruit trees, and scale insects on citrus, of which one of the most important is the San Jose scale *Aspidiotus perniciosus*. In the former instance they are used either to replace partially lead arsenate sprays where there is a danger of excessive residues of this poison being

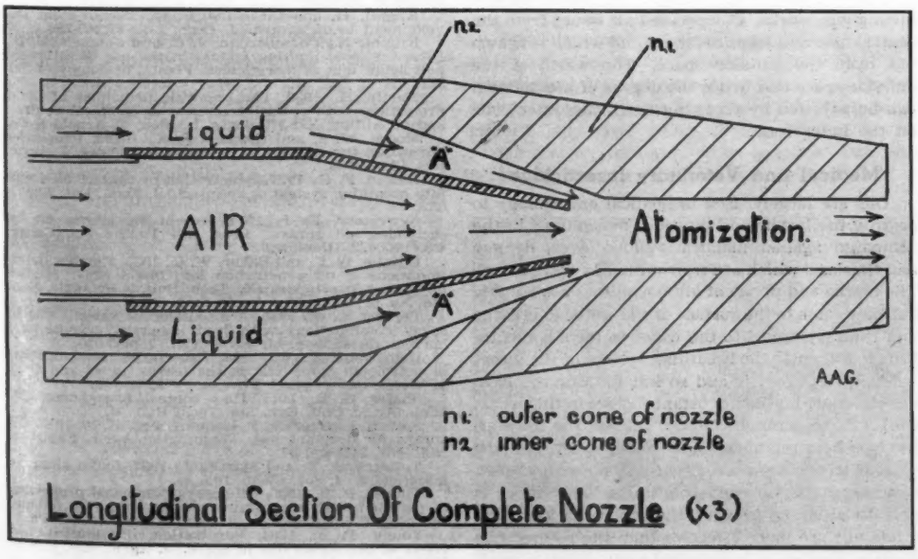

Figure 2

left on the fruit or in combination with lead arsenate to increase its efficiency. Oil sprays are employed in this way in all countries in which dry summers are common. Oil sprays are also used in England in the summer to control 'fruit tree red spider' *Oligonychus ulmi*. Oil sprays may replace hydrogen cyanite tent fumigation of citrus plants to control scale insects or may be used in conjunction with this method. It is feared that continual spraying may have a cumulative deleterious effect on the plant and that continual fumigation may result in the breeding of a resistant strain of scale insect. An alternation of the two is therefore often practised. Citrus plants are sometimes sprayed with oil before fumigation, because this is thought to increase the effect of the fumigation.

Summer oil sprays have normally 1-2 per cent strength of oil in the diluted emulsion.

Winter oil sprays are employed in England and elsewhere against the eggs of the 'capsid bugs' *Plesiocoris rugicollis* Foll. and *Lygus pabulinus* Linn., the eggs of fruit tree red spider *Oligonychus ulmi* Koch, overwintering adults of wooly aphis *Eriosoma lanigerum* Hasum. and against the 'winter moths.'

Winter oils are used at 5-7.5 per cent of oil in the diluted emulsions. Petroleum oils appear to be somewhat specific so that with some species of insect in their action against over-wintering stages of insects, it is necessary to use a tar distillate wash.

Oil sprays are chiefly used in glasshouses against greenhouse red spider *Tetranychus telarius* Linn., but they are also used against several species of thrips, scale insects and mealy bugs. Oil sprays may cause edema or dropsy of glasshouse plants by interfering with their transpiration. The susceptibility of the plant varies with the species.

The above list contains only the most important insects against which oil sprays are a recognized method of treatment.

Petroleum oils, because of their chemical inertness and capacity for wetting plant and insect surfaces, are often used in sprays in combination with other toxic materials such as lead arsenate, nicotine, pyrethrum and derris in the summer, and with tar oils in the winter. They are sometimes used in combination with a fungicide.

Oil sprays are normally applied to plants in the field by means of power spraying machinery at pressures of about 800 pounds to the square inch. Pneumatic knapsack sprayers may be used on a small scale, while on very large areas aeroplanes have been used.

Household and Industrial Insecticides

Large quantities of petroleum oils are used in household and industrial insecticides, but they invariably act as carriers for other toxic agents such as pyrethrum, the thiocyanates or derris. In the last instance some accessory solvent has to be used. An odoriferous substance is frequently added, which may or may not have any insecticidal value.

A colorless, odorless, volatile fraction is required for household sprays and the following specification is recommended (Anon. 1935):

A.P.I. gravity 49-50. Flashpoint open cup 120° F.; initial boiling point 350° F.; endpoint 510° F.; Saybolt color = 30+; odor slight; iodine number Hanas = 1.

A rather more volatile oil base is required when the sprays are intended for use against clothes moth. An oil having a flashpoint 115°-125° F. open cup, an initial boiling point of 325° F. and an endpoint of 45° F. is then used.

Household sprays may contain up to 60 per cent of carbon tetrachloride to prevent fire risk.

The standard usually adopted for household sprays is a pyrethrum spray with a content of 0.1 per cent pyrethrins, which is equivalent to an extract containing the pyrethrins from 1 pound of flowers of 0.9 per cent pyrethrin content in 1 gallon of oil.

Household sprays are used against all the insects occurring in houses, but chiefly against adult flies and mosquitoes. Their effectiveness against other species of insect found in houses depends on the additional toxic agent used and the technique of application.

Household sprays may be applied by means of hand-worked atomizers, such as the "Flit" sprayer, or by a small electrically-driven atomizer in which a small electric motor is incorporated.

A complete account of pyrethrum household sprays is given by Gnadinger 1936. He describes the most recent developments of household sprays, their uses and the methods of testing them.

Oil sprays are employed in industry against the pests of the stored goods and as in the household sprays, they are usually only a carrier for the accessory toxic agent. They have been recommended for cleaning empty grain storages infested with the grain weevils *Sitophilus granarius* and *Sitophilus oryzae*, but there is no detailed account of any experiments. An important use for an oil pyrethrum spray is in the control of the Indian meal moth *Plodia interpunctella* Hb and the Cacao moth *Ephestia elutella* Hb., which are two of the most important pests of stored foods in warehouses (Potter, 1935). This oil pyrethrum spray differs from the usual household spray in the oil used, which is an odorless, tasteless, white oil, similar to medicinal paraffin and having the following specifications: Specific gravity 0.862, flashpoint closed 320° F., flashpoint open 335° F., viscosity Redwood 1 at 70° F. = 118 seconds, pour test —30° F., and sufficiently refined to be odorless and tasteless. There are two reasons for the choice of this oil. It is used upon food and must therefore have no odor or taste which could taint the food and it must be nonvolatile so that it forms a film over the exposed surfaces of the warehouse. The film formed by atomizing this insecticide in the warehouse is lethal to any moths of the species *Ephestia elutella* Hb or *Plodia interpunctella* Hb which settle upon it. The pyrethrum is used at a concentration of 0.8 per cent which is high when compared with the 0.1 per cent pyrethrin concentration which is the standard fly spray strength. A very light film of this insecticide on an absorbent wood surface kept in diffused light can remain effective against the moths of the species for longer periods than a fortnight.

Figure 1 shows the apparatus used for atomizing this insecticide. It is worked at pressures of 45 to 65 pounds per square inch, but not less than 45.

Figure 2 shows the principle on which the atomizing gun works. Compressed air issues from the central hole and atomizes the liquid which is drawn out from the annular space. The width of the annular space and hence the degree of atomization can be adjusted by screwing down the outer cone on the inner cone.

Medical and Veterinary Insecticides

Oils are largely used in medical entomology to destroy the larvae and pupae of mosquitoes in the campaign against malaria, yellow fever, dengue and filariasis which are transmitted by mosquitoes. The larvae and pupae of all mosquitoes are aquatic but they come to the surface of the water to breathe and if oil is applied to the water to form a surface film, it will enter the breathing system of the insect when it rises for air and so kill it. Murray, 1936, has summarized the important factors in this work. Oils of boiling range 200°-300° C. are the most effective, because above this range they are too viscous to penetrate the breathing pore and below this range they are too volatile and the insect is able to react to prevent their penetration. The crude oils are more effective than the refined oils because they exert a chemical toxic action as well as the purely physical stifling action of the refined oil. Furthermore the crude oil will spread and form a film more easily than the refined oil.

The oil is applied to the surface of the water in a variety of ways, which depend on the circumstances. A pneumatic knapsack sprayer is efficient for small areas.

Oils are also used as stock sprays to prevent flies from attacking dairy cattle. Attacks of such flies as the stable fly, *Stomoxys calcitrans*, result in reduced milk production. Considerable care must be taken when using oils on cattle because they can easily affect the health of the cow. A summary of these effects is given by Regan and Freeborn, 1936. These authors consider that a water emulsion of pine oils, pyrethrum and small amounts of petroleum oils is better than an undiluted oil spray. Probably the most important characteristic of a spray for this purpose is that it should possess a repellant effect as well as being toxic to flies. A suggested specification for a stock spray oil is given (Anon., 1936): Viscosity Saybolt 1 at 100° F., 45-50 seconds; flat distillation curve, most of the oil distilling between 550° F. and 650° F., and with an endpoint of not over 700° F.; sulfur content not over 0.4 per cent; unsulfonateable residue of not less than 70 per cent. If the oil is too light it burns the cattle owing to its solvent and penetrating powers; if it is too heavy it interferes with the physiological processes.

It can be seen from this brief survey that petroleum oil plays a large part in insecticides in all fields of applied entomology, but that a considerable amount of further research has yet to be done before they can be utilized to the best advantage.

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Cia. Mexicana Aerofoto

Tuxpam bar—looking south. Cia Mexicana de Petroleo "El Aguila" terminal

Mexican Output Shows Gain Despite Labor Difficulties

Any resume of the conditions under which the oil industry is now operated in Mexico must necessarily be concerned mainly with the labor conflict which affected the major companies over the entire year. Exploration and production were both limited by the uncertainty of labor conditions, and exports and domestic sales were necessarily dependent upon production.

Although complete figures are not yet available it is estimated the total production during 1937 reached approximately 46,000,000 bbls., a gain of almost 5,000,000 bbls. over 1936, due to a large extent to an increased production in the important Poza Rica field where wells responded favorably to acid treatment. Pipe line facilities were increased by installation of a new 12-inch line, 62.5 kilometers in length, between Poza Rica and Tuxpam. Late in the year an important agreement was signed between the Mexican government and Cia. Mexicana de Petroleo "El Aguila" providing for a unit exploitation of certain properties in the Poza Rica area.

This important step will undoubtedly increase production. However, it is essential to clear up the fact that the agreement did not stipulate a royalty on future production for the government but, as a means of settling extrajudicially conflicting ownership claims, a participation was granted the government by private contract in the production of the field. Another factor which has acted to increase production during the year was creation of the official government petroleum agency, Administracion General del Petroleo Nacional (familiarly known as "Petronac") which took over the properties and equipment of the former "Petromex" and conducted a steady drilling program which is expected to produce substantial results during the present year.

During the year some 40 wells were completed in the republic, of which 25 were productive with an initial average capacity of 8,813 bbls. per day.

About the middle of the year, it was estimated by company experts that the total production in Mexico at its existing rate would reach the substantial total of 60,000,000 bbls. in 1937. That the gain over 1936 was limited to 5,000,000 bbls. rather than to 20,000,000 may be attributed to the serious strikes, chiefly affecting Poza Rica, and to the innumerable "paros" and other minor labor conflicts which curtailed operations. The general strike lasted 13 days and involved almost 18,000 men; in addition, the Poza Rica field was out 58 days, affecting some 2,000 workers, while 47 paros, or illegal stoppages of work similar to the sit-down strikes of the United States, affected the industry during the year with a total loss of over 1,200 working hours.

Exports

Total exports from Mexico for 1937 ran above 25,000,000 bbls. Fuel oil was the chief export and its principal demand came from the United States. Heavy crude and gasoline were the other main exports, the first going chiefly to the United States and to Germany, while gasoline found its principal market in England and the Continent.

Part of workers' colony at Poza Rica

It has been estimated that, roughly, 40 per cent of Mexico's total exports went to England and the Continent and a slightly smaller percentage to the United States.

Domestic Consumption

Domestic consumption of oil products reached approximately 20,000,000 bbls. during 1937. Both fuel oil for industrial purposes and gasoline showed increased consumption. It is estimated that gasoline sales totaled 132,000,000 gallons, a substantial increase. Unquestionably the opening of new roads and highways through the republic gave rise to this increased gasoline consumption. Tourist travel rose considerably with completion of the International Highway from the Texas border, reflected in the fact that car movements through Laredo increased from 20,619 in 1936 to 30,149 in 1937.

Taxation

Complete figures are not available yet on the total taxes paid by the industry during 1937. However, on the basis of taxes paid during 1936, it is possible to estimate that the total tax revenue derived from the industry was approximately 65,000,000 pesos in 1937. Roughly, 55,000,000 of this total corresponds to direct taxes, including, approximately 40,000,000 for the gasoline consumption tax (state and federal), 12,000,000 for the production and export taxes, and the remainder in the surface tax, etc. Indirect taxes such as all general industrial taxes, the 10 per cent additional federal surcharge, the income tax, the capital export tax, the stamp tax, port charges, etc., are estimated at 10,000,000 pesos on the basis of the 1936 yield. It has been estimated that the revenue derived from direct and indirect taxes on the oil industry amounts to, roughly, 14 per cent of total federal revenue. No new specific taxes were imposed during the period nor were there signal changes in either tax structure or rates, but mention must be made of the new 3 per cent tax col-

lectable on all goods shipped into Mexico, a modification of the income tax law.

Labor Demands

In November, 1936, peremptory demands were received from the Union of Petroleum Workers of Mexico by all the major petroleum and shipping companies operating in Mexico, accompanied by threat of strike if a general collective agreement were not completed within 10 days. This ultimatum alleged "the discontent of petroleum workers and the existing lack of economic equilibrium due exclusively to the diversity of working conditions obtaining in the industry."

The demands of the union were completely unacceptable to the companies. The draft severely restricted the right of company management by limiting the number of nonunionized workers, movement of personnel and hiring and firing of employes. Moreover, such extensive social and economic privileges, substantial increases in wage schedules and extra rates of pay were demanded it was calculated the total benefits would have increased labor costs to the companies by approximately 500 per cent.

Due to conciliatory efforts of President Cardenas and of the Labor Department the threatened strike was averted temporarily by the holding of an employer-labor convention called "to conclude within six months a collective contract to be obligatory upon the industry." Although many existing individual company contracts had not expired, the companies agreed to this convention, but presented a completed counter-proposal which represented a considerable increase in benefits for the workmen. However, within less than 24 hours the labor delegation in the assembly rejected every clause of this counter-proposal.

The General Strike

Proposed salary increases were based essentially upon the importance and responsibility of each man's work. This too was rejected and the same afternoon the union formally reminded the companies the general strike would be called on May 27 if the "discussion and approval" of the draft-contract of the union had not been completed. Promptly at midnight May 27 the union called out all workers, field, refinery, sales, etc. Two days later a communication was received from the union in which a "conciliatory" basis for ending the strike was proposed. The only substantial curtailment of the original demands was reduction of the minimum wage from 7 pesos per day to 6. Some of the 34 points included were new, including a peremptory term of 10 days for agreement on all clauses of both the demands and the companies' counter-proposals to which there were no "basic objections" and 30 days for agreement on all other clauses.

Characterizing this so-called "conciliatory basis" of the union as a "mockery" not only to the companies but also to the federal authorities, the employers' delegation withdrew from negotiations. However, under a further personal appeal of the president for an early settlement, the companies shortly after made a conditional offer to increase the minimum wage proposed by them and further to increase several economic and social benefits. The companies' offer was summarily rejected by the union and no further official steps were taken until June 7 when the union issued a public statement it would change its tactics by taking the case to the federal board of mediation and arbitration as an "economic issue."

The general strike had then lasted some 10 days and the acute shortage of gasoline and fuel oil in the republic had created an extremely unfavorable public reaction to the strike movement. On June 9 the union voluntarily lifted the strike to adopt its "new procedure." The so-called "economic issue" involved an investigation by the Labor Board to determine whether the companies were economically able to establish the new working conditions. Thus, the issue became the first important test of the government's theory that "the demands of labor should be limited solely by the economic capacity of the employer."

The companies immediately challenged this procedure since the federal labor law invoked was expressly designed as a protective measure for the employer in times of economic stress when certain conditions, such as a precipitate rise in raw materials or a precipitate drop in prices, necessitated an adjustment of contractual obligations to continue operating. Actually, this procedure of investigation was designed by the legislators as a counterpart to the right of strike. Nevertheless, the labor board ruled the procedure was proper and the economic controversy began.

The Economic Issue

The board named a group of three government experts to examine conditions of the industry and to formulate a report upon which, and the objections thereto, the Labor Board is compelled, under the law, to base its final decision. On August 3 this experts commission rendered its report. The financial condition of the companies was classified as so "extraordinarily lucrative" they could afford to pay increased salaries and benefits to their workmen in an amount of approximately 26,000,000 pesos per annum. It was immediately apparent the opinion of the official commission was couched in biased and aggressive terms against the companies, that mistaken zeal had led the experts to include many considerations which had no relation whatsoever to the issue; that almost all the points contained inexact assertions or imputations with little or no foundation in fact; and that various conclusions were not supported by proof of any kind.

The report could be regarded by the industry only as an attack since it was directly accused of illegal operations, concealed bookeeping methods and of sharp practices in manifesting prices and sales, all with a view to evading its obligations to the government and to the workmen. So clearly prejudiced against the companies was the report they were forced immediately to make a formal announcement they would not accept responsibility for the consequences of the findings since the situation in which the commission of experts attempted to place them would render economically impossible continued operations.

Th fundamental basis for the recommendations was the allegation by the experts that the industry was obtaining enormous profits and that the unamortized capital returned almost 17 per cent during 1934-1936.

As provided by law, the companies were given a mandatory period of 72 hours to file a formal brief of objections. On profits, the companies showed by the books of the nine principal companies operating in Mexico that the percentage of profits in relation to unamortized capital investment during 1934-1936 was only 7.5 per cent instead of the 16.81 per cent estimated by the experts. The experts had estimated wholly imaginary profits: first, by assigning arbitrary prices to export sales, and, second, by rejecting expenditures accepted in regular commercial and accounting practices. In fixing export prices the experts compared trade journal quotations with those on company invoices, deriving that the companies were undermanifesting the value of their sales and thus concealing profits. In so doing, the experts failed to note that the prices in trade publications do not correspond to purchases and sales actually effected but to offers made by sellers. Furthermore, the important factors of volume of sales, terms and specifications of products were completely ignored. Absurd lengths were reached in rejecting such expenditures as tax charges, for the exportation of capital, income tax payments and the like.

On costs the companies' calculations were at wide variance with the calculations of the experts. The total cost of extending the additional yearly recommendations by the experts would have raised costs in the estimation of the companies by over 40,000,000 pesos in contrast to slightly over 26,000,000 shown by the report. The substantial difference was due chiefly to the fact the basic payroll of the industry for 1936 upon which the percentage of increase was based was underestimated by the experts in some 4,000,000 pesos. This difference was of vital importance as the percentage of increase based on the figure used by the experts was only 26.18 per cent, whereas the percentage of increase on the correct figure was 49.12 per cent.

Proceedings Before the Board

Following the filing of objections, a hearing before the Federal Labor Board was held for the express purpose of "presenting fresh evidence or of destroying the value of statements made by the official experts." Hearings began on August 19 before a Special Group, No. 7, of the Federal Labor Board designated by the Department of Labor over objections of the companies who challenged in the courts the competency both of Special Group No. 7 and of its chairman who was specially appointed when the regular chairman was excused. Many important proofs of the companies were refused as evidence and such short periods were designated for offering others it materially affected their value. At one point the board refused to admit the companies' books, notwithstanding an economic and financial investigation was involved. The companies submitted an interrogatory to the experts in an endeavor to clear up contradictory and confusing points in the report of the commission. The experts commission finally answered this questionnaire, but the replies were evasive almost to worthlessness. Of the 143 questions, more than 50 were not answered, and many replies were given in such a manner as to uphold the previous

(Continued on Page 226)

Absorption plant at Poza Rica. Machine shop and stores in rear

Backside Crank Pumping Being Greatly Extended

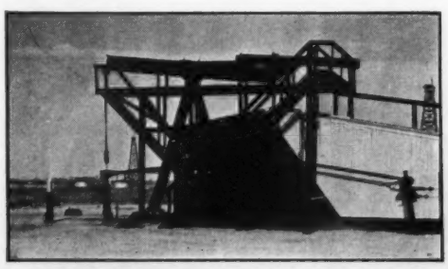
Backside cranking has rapidly assumed a prominent part in oil-well pumping methods during the last few years. This method was first considered a sort of expedient or temporary cost-saving measure. Economic considerations, and low daily allowables following the advent of proration restrictions (and the knowledge that they are here to stay) has served to stimulate the extensive use of backside crank pumping, as well as to extend its use to heavier and heavier pumping wells.

Following rapid improvements in design, bearing construction, intermediate swings and other paraphernalia, backside cranking has been securely established as a durable, permanent and economical installation for a wide range of pumping conditions. The accompanying development of the efficient well pulling or servicing units also made this transition possible and practical.

This system of oil-well pumping offers a flexible means for use in filling the gap that long existed between wells requiring the standard rig or heavy-duty geared units, and the shallow small producers suitable for bandwheel or geared power pumping. The inflexibility of cycles for jack wells operating off of central powers also encouraged the use of backside cranking under some cases.

In addition to the major item of balance which must be worked out in all settings, backside cranking also involves all the mechanics in the design and operation of rod-lines, swings, posts, etc. Although similar in principle to those on central powers, larger lines are required due to the greater loads at greater depths, and to permit the greater flexibility of pumping cycles. Correct alignment of rod-lines on backside cranking installations, as well as the elimination of all friction losses possible, are especially important on such heavy-duty installations.

A wide variety of construction exists between the homemade auxiliary members of such installations and the most modern and efficiently engineered products produced. Even the well engineered equipment varies considerably in details of design, especially on such items as bearings, bearing settings, vertical swings with take-offs, post or horizontal swings, stroke posts and their counterweights, 180-degree swings, hold-ups and hold-downs, pitmans and stirrups. The principle of the power take-off and auxiliary transmission units made by the different manufacturers appears to be common to all, however. Briefly, a backside crank assembly is a push-and-pull arrangement receiving its power from a central source, whereby loads exerted in one direction are compensated for in another, in effecting a close balance and a smooth, economical overall operation.



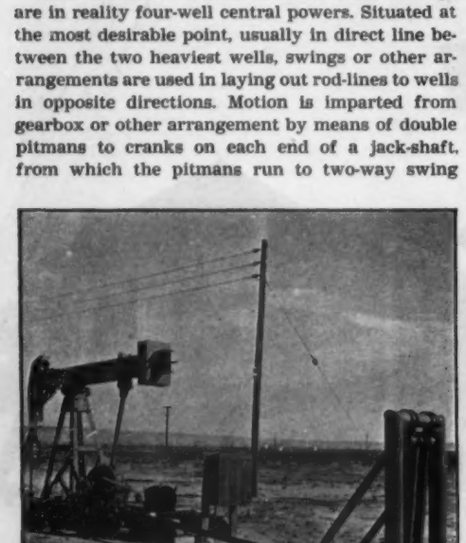
Three-well hookup in the North Cowden field of Crane County, western Texas, showing standard rig as central unit, with two-way take-off bearing. This allows two opposing wells to be pumped

Two-well hookups are of two general arrangements. First, where the usual pumping unit is set at one well, the second well being pumped by pull rods and jack connected to a backside crank. The second type two-well hookup places the power unit (consisting of motor, reduction gear and stroking member) midway between the two wells, each receiving its reciprocating motion from a two-way stroke post operating off the crank on gear box. Only slight counterweight (if any) is needed in such cases to care for any differences in weights of the two wells.

Three-well hookups employ the conventional standard rig or individual unit at one well, situated at the most advantageous position between the two others. By means of a backside crank to two-way swing post, rod-lines extend out to both outpost

wells. Some form of either beam, rotary or dummy counterweight must be provided in such installations to compensate for the well which operates independently of the balance afforded between the other two.

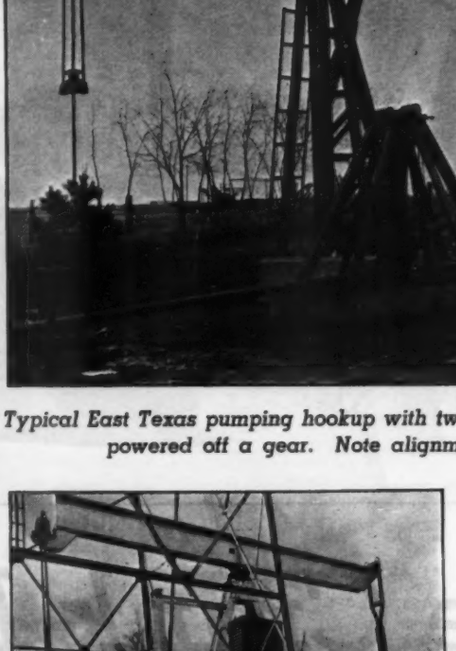
Conventional four-well backside-crank hookups are in reality four-well central powers. Situated at the most desirable point, usually in direct line between the two heaviest wells, swings or other arrangements are used in laying out rod-lines to wells in opposite directions. Motion is imparted from gearbox or other arrangement by means of double pitmans to cranks on each end of a jack-shaft, from which the pitmans run to two-way swing



Two-way hookup, showing a 7½-hp. motor pumping two wells in the Crane-Cowden field of West Texas. Power transmission is through V-belt to small gear reducing unit, with cranks set 90 degrees apart, one to the pumping unit and the other to the backside swing post nearby. Complete balance is maintained by adjustable irons on unit beam

posts for continued extension through rod-lines to the wells. The need for balance dictates that the two cranks be set 90 degrees apart, and by taking one well off each direction of each crank, a very uniform power load and minimum power demand is accomplished. Some homemade but highly efficient four-well installations use endless belt drive from engine to individual bandwheel settings, off of which cranks on both sides operate rod-lines in four directions.

Typical East Texas pumping hookup with two wells being balanced through a swing and powered off a gear. Note alignment of rod-lines through building



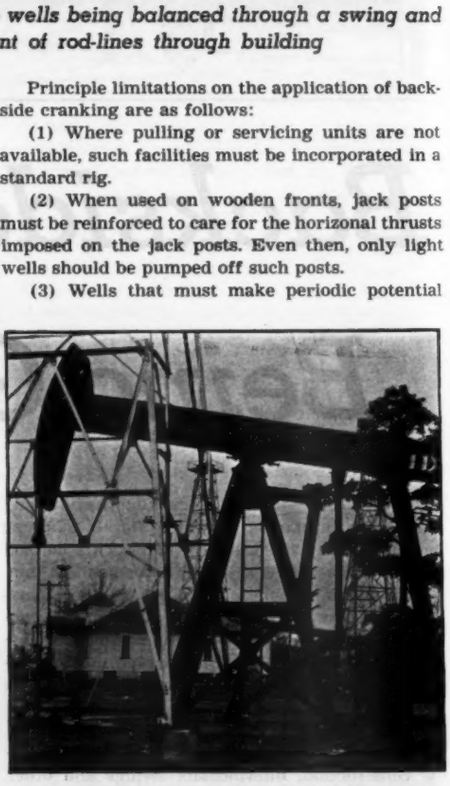
Two-way hookup. V-belt transmission delivers power to gearbox, from which one crank pumps the center well and the other drives pitman to one- or two-way stroke post. The balancing iron on post beam is readily moveable by manually operated wheel

Principle limitations on the application of backside cranking are as follows:

(1) Where pulling or servicing units are not available, such facilities must be incorporated in a standard rig.

(2) When used on wooden fronts, jack posts must be reinforced to care for the horizonal thrusts imposed on the jack posts. Even then, only light wells should be pumped off such posts.

(3) Wells that must make periodic potential



Unusual two-well hookup in Kilgore area. Note vertical arm attached to beam

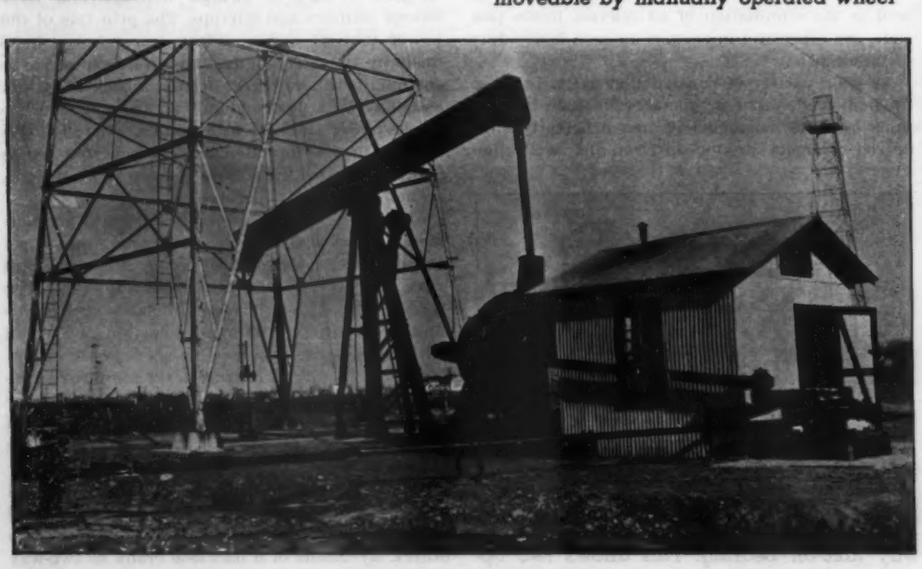
tests for allowable purposes, and cannot establish a favorable one on the maximum cycles permitted with backside cranks.

(4) Where surface conditions prohibit the economical installation and operation of rod-lines.

(5) Where fast or long enough cycles cannot be obtained through rod-line operation to lift all the fluid required.

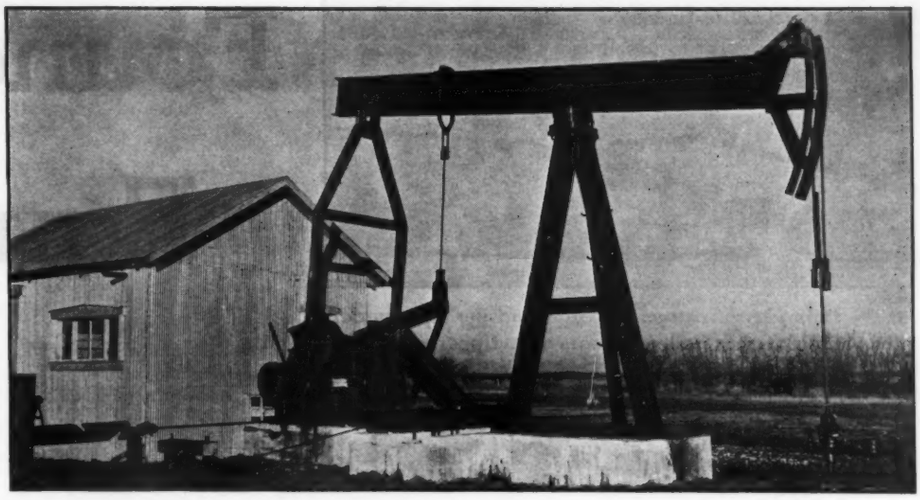
(6) Where weight of wells exceeds the practical strength of the largest size rod-lines (hardly ever over 1-inch in size). Over-weight usually shows up faster in excessive breaking of pull-rods, but it also exerts a damaging effect on other intermediate parts of the assembly.

Outside of rod-lines themselves, bearings



Three-well backside arrangement permitting 90-degree change in direction of pull

throughout the transmission represent the points of greatest weakness, and for that reason have received very careful consideration in the design of all modern units. Durable dustproof self-lubricating bearings have perhaps done as much or more than any one other improvement to afford backside cranking its practicability and economics in maintenance of operation. They have also extended their application to wells of greater weight and depth. These include the single or double wrist pin or take-off bearings, pull-rod connecting bearings, rocker bearings, jack-post bearings, and pitman bearings. The enclosed type oil bath or roller bearings are widely used. In anti-friction bearings of all kind, the smallest clearance that can be used and still allow for heat expansion, is desirable in order to minimize shock loads imposed on the bearings during operation. Such improvements have done much to reduce friction losses and extend the range of application for backside cranking.



Backside cranking off a unit located in the Rock field of Kansas

Balance

Proper balance is undoubtedly the essence of any efficient backside crank operation, as it is for any form of pumping. Whereas the power required to produce a well on individual unit varies directly with the amount of fluid being lifted and the depth. backside crank power requirements are proportional to the balance effected in the system. Any combination or setting that will minimize peak loads of power input will also reduce the stresses to which mechanical parts are subjected.

In seeking this all important matter of balance in installations of any of the above three mentioned types, the trial- and error-method is usually resorted to. It is true that individual wells could be weighed and rather accurate calculations made while laying out the installations, but any figures involving friction losses through the bearings and rod-line travel will be only rough approximations, and the trial and error method will be employed in the end. By considering rod and rod-line sizes, gravity of oil, distances from power, and fluid levels, calculations can be made on necessary counterweight throughout the installation, but the trial experimentation is necessary in the end when the assembly is put in operation.

Two-well backside pumping unit in Talco, Texas

The finding of a proper balance is made considerably easier when multiple-cylinder engines are used as prime movers. Here the unbalanced points in the cycle show up in a laboring of the engines. Such unbalanced peaks do not so readily reveal themselves on internal-combustion gas engines which benefit from the large flywheel effect. Irregularity of loads, or unbalance, show up on electrical motors through the tendency to heat excessively.

In achieving the most efficient balance through the complete installation there are a few simple and well established rules which should govern the position of cranks and location of counterweights. Local conditions, or great variations in depths, weights, or distances from power source of the different wells included, may alter these generalized rules under certain conditions, however.

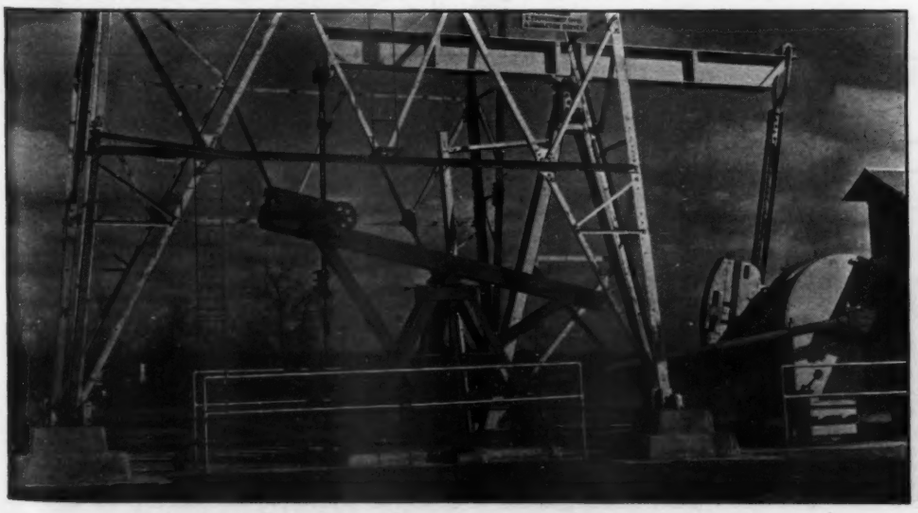
In two-well hookups, one well receiving its pumping motion off backside crank from the pumping unit at the other, they may be counterbalanced against each other by setting the crank at 90 to 270 degrees to each other, and allowing the forces to act in phase or in opposition. Since all forces are acting in a horizontal direction, the cranks located at 90 degrees with respect to one another will cause the power cycles to overlap and "smooth out."

In two-well hookups where two wells operate off of the same crank from an intermediate power setting, no counterweight is required unless there is a marked difference in the weight of the two wells, or unless the occasion is anticipated when one well will be hooked off sooner than the other. In the latter case, one of the improved type adjustable balance two-way stroke posts may be employed to advantage.

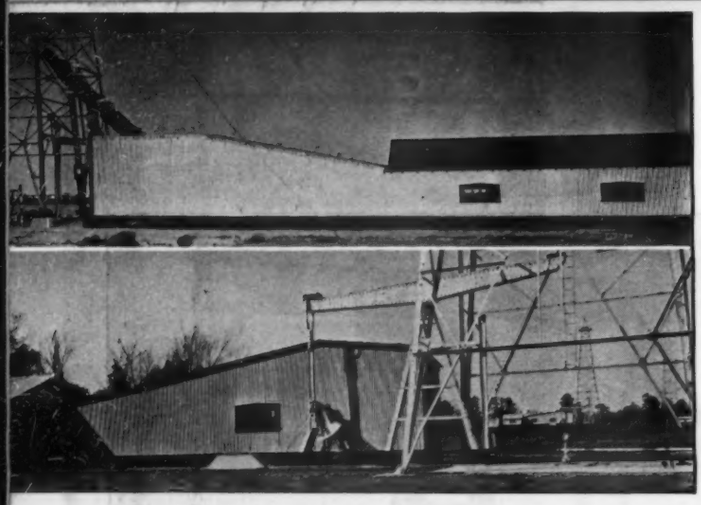
In the three-well hookups, where unit is at one well and power take-off to two-way stroke post for pumping of two additional wells in opposite directions, counterweight should be on the two-well crank and 90 or 270 degrees from the one well.

In a four-well hookup, cranks should be 90 degrees apart so the power impulses will overlap in each cycle. If wells in opposite directions are somewhat similar in weight, friction losses comparable,

(Continued on Page 97)



Compact three-well backside crank pumping installation in Talco field of Texas



Foundation for Equipment Is

Fig. 1—Examples of extremely large and perhaps burdensome pumping fronts built few years ago. Upper view taken in Hobbs, New Mexico; lower in East Texas. Both have been built several years and have become antiquated before being needed for pumping service in these fields

The problems and expense incident to the construction of pumping-front foundations, which at one time were major factors in equipping wells, have been greatly simplified during recent years. This is due largely to the transition from long standard rig fronts to the compact pumping units, backside-crank installations, the short center endless-belt drive standard rigs, or V-belt transmission. Also, the former large and sometimes massive pumping-front foundations were targets for economies in construction, and the newer ones have been greatly simplified since solely as a matter of economy if nothing else.

With the advent of the short-center endless-belt or V-belt drives, one of the important savings claimed was in the smaller foundation and building required. The extensive use of small and compact individual pumping units (often referred to as portable units) further reduced foundation costs. Practically all units of this classification, together with their prime mover and transmission equipment, are now mounted on steel I-beam foundations, fully unitized and portable. This is in contrast with earlier methods whereby the sampson post or jack post designs called for a concrete foundation 2 or 3 feet high. Now they are usually manufactured with a full-steel base.

The pumping foundation problem in normal settings is being made simple so far as the operator is concerned because many of the units are quoted and sold on an installed basis. Where they are sold without the installation charge included the manufacturer generally specifies or suggests the most desirable type of setting.

Figure 3 shows a group of unit foundations which typlify compactness and simplicity.

Topographical conditions, of course, govern to a large extent the size and type of foundation where normal settings are not possible. A peculiar soil condition may require special consideration in making permanent installations. Much has been written on pumping foundation problems in the marsh land areas of the Gulf Coast, where a wide variety of steel substructures, rafts anchored by piling, or other means are employed to meet the severe local conditions. Somewhat the same conditions prevail on the river bed leases of several inland fields, or in low parts of the field subjected to overflow during rainy seasons. Figure 2 shows a low place in the East Texas field which often is overrun with water. Such conditions, however, are not representative of the overall problem, and require consideration only as local circumstances demand.

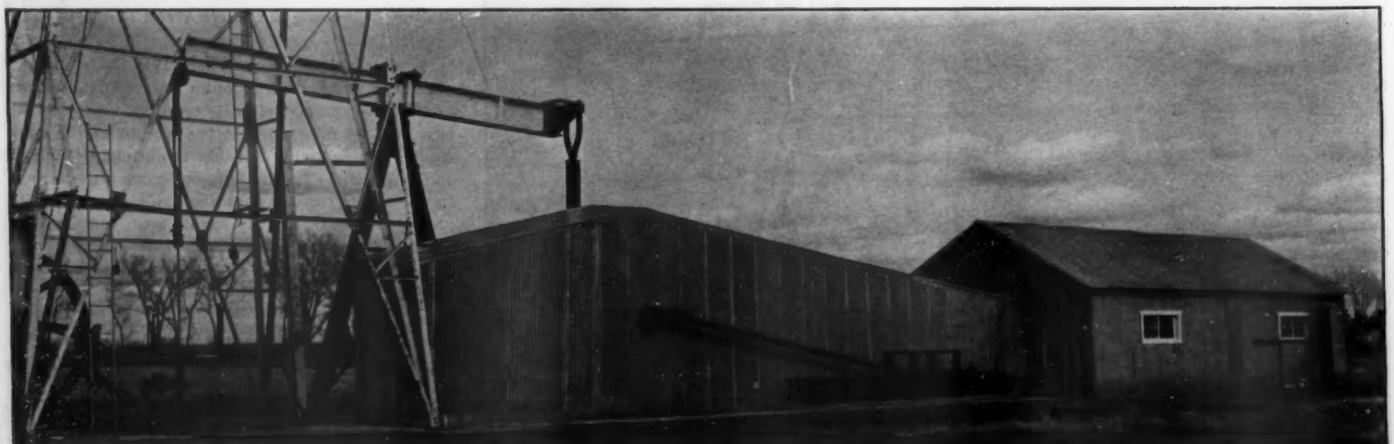
Fig. 2—Lowland area in East Texas field during flood stage. Local conditions warrant special consideration to high pumping foundations when thus threatened

Still Being Studied

Even after reducing pumping foundation costs several hundred per cent over the past few years during the transition in surface-lifting equipment, this item of expense is still being studied closely by operators in all fields, and short cuts and savings continue to be made by unique ideas and application of good engineering practices.

Some of the more recent short cuts or savings which have been effected in pumping foundation expenses are discussed.

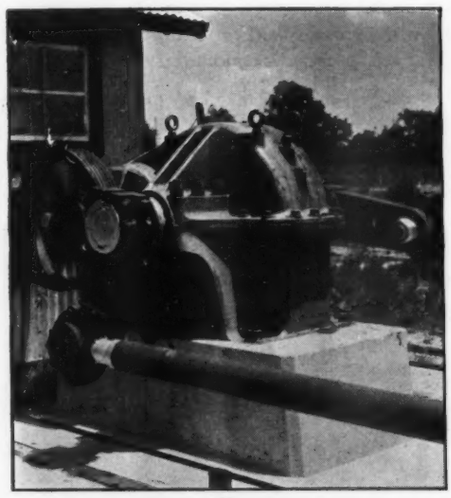
In the Goldsmith field of Ector County, western Texas, where constituents of the native soil permit embankments of earth and local rock to settle into very hard masses, the only concrete used by some operators is in the engine house floor. Figure 7 shows two views in this field; the first is of a flow-



Rig front foundations must often support backside crank equipment. Here is shown a two-well hookup used in the Hauschild pool, Kansas

Modern Pumping Relatively Simple

ing well which has been banked up about 3 feet on a 25- by 25-foot mound. During flowing life of this well this earthen platform will settle and become extremely hard. When pumping equipment is needed, it can be set directly upon the soil as



Substantial foundation typical of type used to support modern gear boxes where several wells are pumped at heavy loads

shown in the second view of Figure 7. Here only a 6- by 10-foot floor for the multiple cylinder gas engine was used.

Figure 4 shows a flowing well in the East Texas field which has just been completed. It is in an area where central power has already been installed, and when pumping equipment is eventually needed, a jack will be employed. Therefore, in pouring the permanent concrete derrick floor, forms were made and a foundation for the pumping jack also included in the original job. The jack itself will not be set until needed, but considerable trouble and expense was saved by equipping the location with its foundation at the time workmen were pouring the floor. On wells where operators plan to install individual units, savings are often effected by placing all foundation bolts or anchors which will be needed in the later setting before concrete derrick floor is laid.

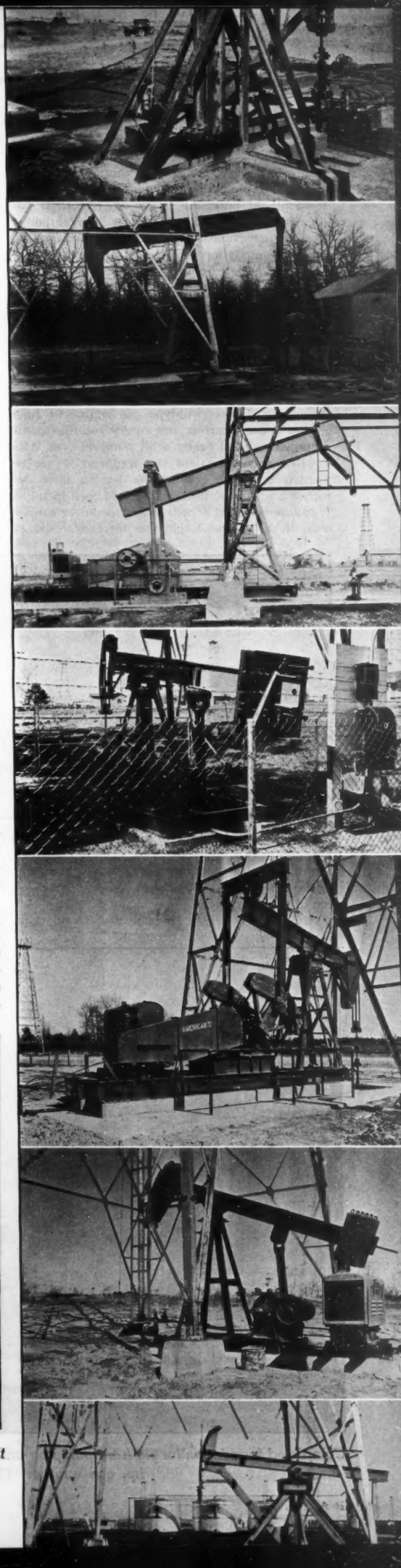
Fig. 3—Typical modern, permanent unit and jack foundations

Temporary Foundations

Money is often saved on pumping foundations for temporary settings of surface equipment. Figure 6 shows a well in the Talco field which operators eventually plan to pump on a central power after sufficient other wells on the property have been completed to warrant its installation. Therefore, to avoid expense of pouring foundation for this temporary unit, it is placed upon large wooden rig timbers as shown. The well can be pumped in this manner for a year or so if necessary, although it is not a desirable permanent setting for obvious reasons.

Figure 8 shows a unitized setting in operation in the Clay City field of Illinois. Here a flat cement floor was poured on the front side of the derrick only, and a large braced I-beam steel foundation set upon it. The sampson post was then mounted at the front end of the steel foundation,

One of the installations supported on piling in the Lagunillas field, Venezuela. This unit pumps the oil from a depth of 3,400 feet making a solid foundation essential



and the complete multiple-cylinder gas engine, transmission, gearbox, rotary counterbalance and pitman on the unit's individual steel foundation were placed upon the larger steel block resting upon the concrete slab. There will never be any loss due to salvage of this concrete, as it is suitable for jack foundation should central power later be built, or can be extended to accommodate a larger unit or standard rig if conditions later warrant such an installation.

Elaborate Pumping Floors

In the Rodessa field of Louisiana, Arkansas and Texas, rather elaborate pumping floors are being laid due to the permanency of the installations. Figure 5 shows such a 6,000-foot pumping-front, employing the vertical-type gas engine in small engine house, gearbox and rotary counterbalance mounted on steel beams with sampson post. Also, a 6-foot square around the wellhead is not cemented as is the rest of the derrick floor, but rather a square of steel grating has been installed. It can be removed at will to service lower connections on the wellhead, and also prevents accumulation of oil on the concrete floor, with accompanying hazards to the safety of workmen and deterioration of the floor itself.

Although the size of concrete foundations needed for pumping rigs has been greatly reduced following the popularizing of the compact individual units and backside cranking, important developments have taken place at the same time with regard to general oil field cements, their handling and mixing.

A balance should be struck between the reinforcements used in foundation work, between the ratio of water to cement (which determines tensile

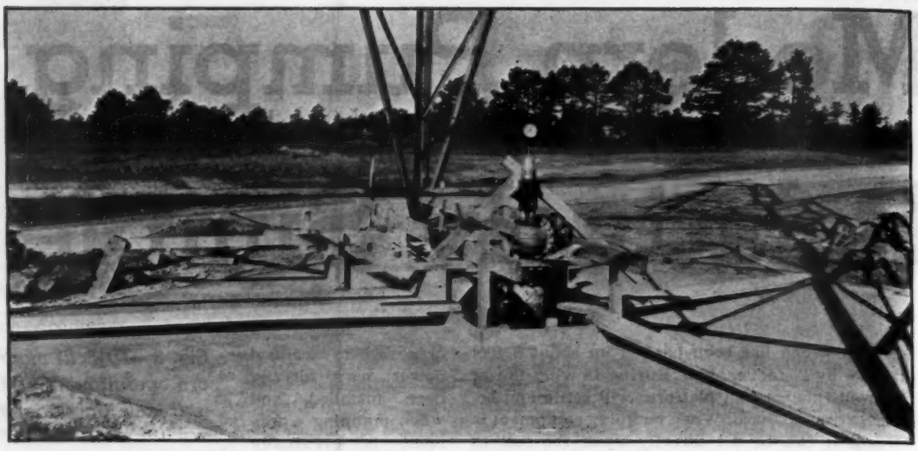
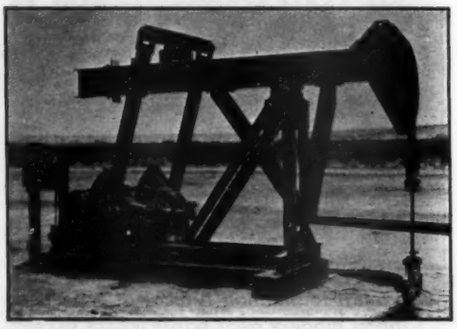
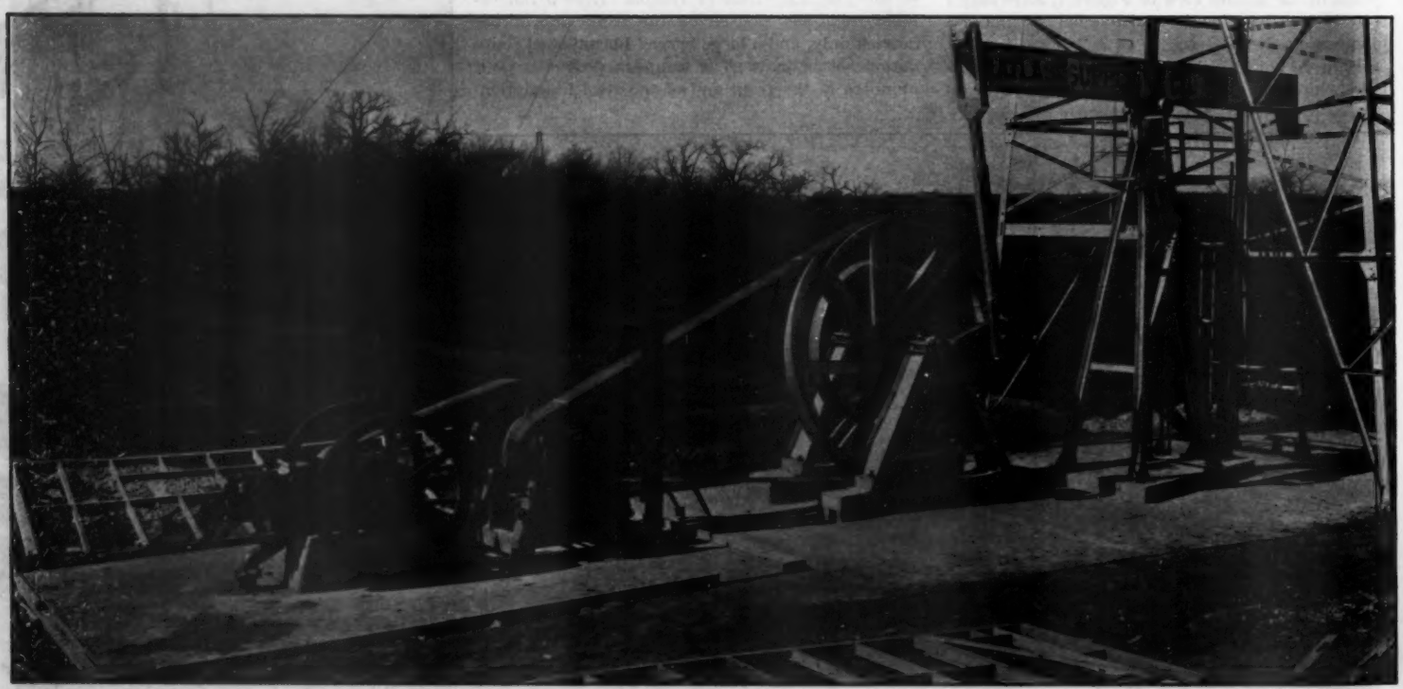


Fig. 4—Flowing well just completed in the East Texas field. Jack foundation was poured at the same time derrick floor was laid, although the former will probably not be needed for many months. This is found to be more economical

Fig. 5—Heavy duty pumping rig for 6,000-foot pumping in the Rodessa field

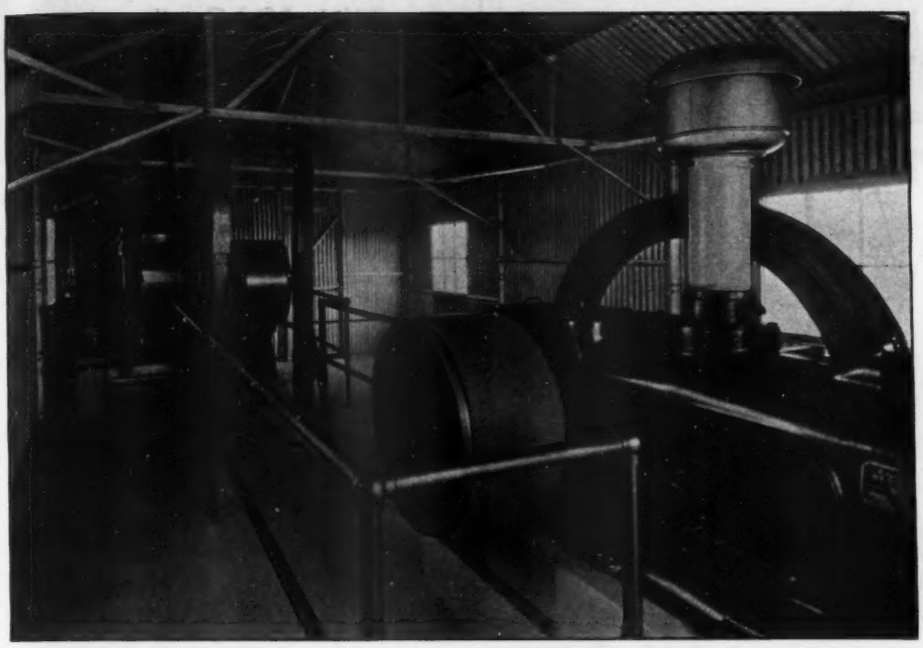


Note simple foundation under this electric motor-driven pumping unit on shallow well



Completed foundation for rig-front pumping unit and engine. Note short hookup. The unit is powered by a single-cylinder horizontal 40-hp. gas engine. This type of installation not only pumps but services the well

Don't miss the large insert—**A Complete Survey of U. S. Production-Equipment Needs for 1938!**



Building and engine foundations are often poured at one time. Here is a typical installation showing standard rig front with chain driven front single-cylinder gas engine belted to short-center counter balance. Note the substantial guards set in the floor

strength) and the service to which the particular foundation is to be subjected.

If the unit is to be under very strenuous pumping conditions, such as might be necessary during potential testing, both the size and the tensile strength of the mass should receive close consideration. When reinforcing irons are to be used in the foundation, a reduction in the percentage of cement to water may be made, and, although by so doing the tensile strength of the cement itself will be cut, the reinforcements will compensate for this loss.

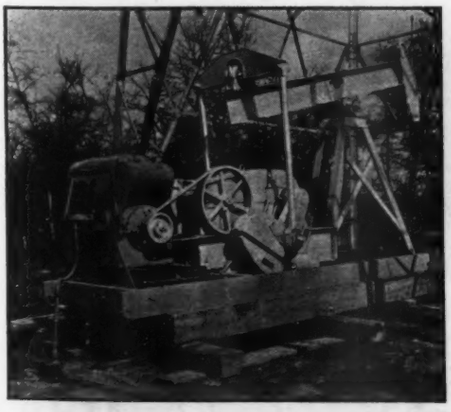
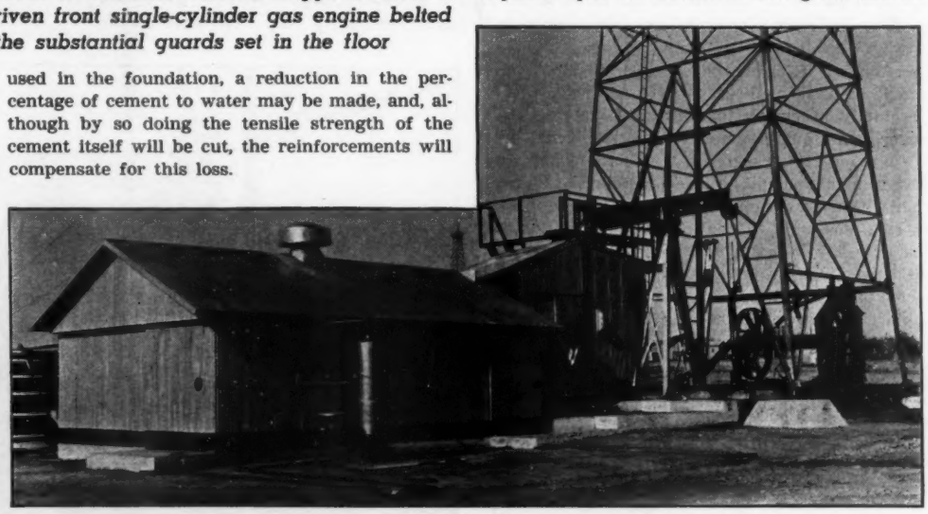


Fig. 6—Temporary foundation seen in the Talco field of East Texas, which will be used until central power is installed



Typical modern, short center standard rig-front pumping unit recently installed in the Crescent field of Oklahoma

If the foundation is not to use reinforcing irons, then a smaller ratio of water to cement must be used to obtain the desired tensile strength. The more water added the more the strength of the cement will be cut.

The following table of strengths of three different setting periods, and for different ratios of water by weight, may be used in calculating cement strengths:

SETTING TIME FOR CEMENT

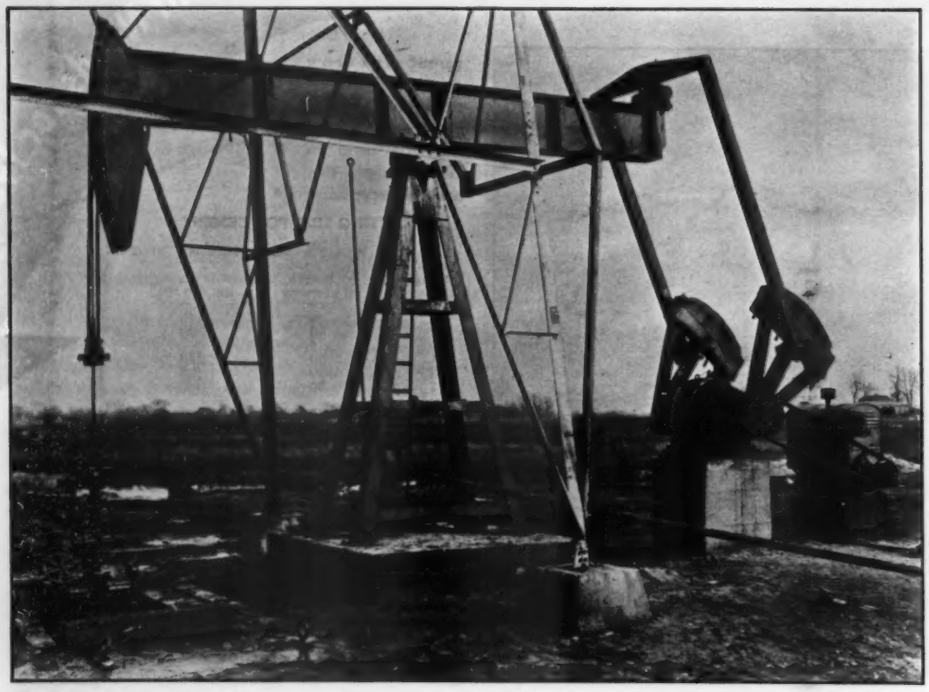
Days' setting time	Water added, per cent by weight of cement	Tensile strength, lbs./sq. in.
1	40	350
3	40	475
7	40	550
1	50	240
3	50	325
7	50	335
1	60	145
3	60	245
7	60	320
1	70	80
3	70	180
7	70	265

There are a few well known rules in the handling of cements which should be followed in laying pumping foundations if best results are to be had.

If pit runs of sand and gravel (which usually have quantities of clay and silt intermixed) are to be used, a greater percentage of cement should be used to receive the desired strength. Dependence is placed upon the cement in such grout slurries to create a cement bond around each solid in the mixture, and with clay particles around the sand and gravel, the cement cannot effect this necessary bond and afford the normal tensile strength of the mass. Wherever possible, sands or gravel should be cleaned of all foreign material before

Fig. 7—Earthen embankment thrown up around flowing well in Goldsmith field of West Texas

Shows same embankment after it has settled and later put into use as the sole foundation for pumping unit



Typical series of sturdy foundations used under modern engine-driven pumping unit of relatively large capacity commonly found in many Mid-Continent fields

use. Water sufficiently pure for drinking purposes should be used in all cases where available. If it is absolutely necessary to use "gyp" water or salt water, it must be remembered that such mixtures will set much quicker than with pure water, and arrangements should be made to pour the foundation within a shortened period.

It is desirable to pour foundation so that by the time it has begun its initial set there will be no danger of too much heat from the sun. If subjected to this heat, cracking may result due to more rapid evaporation of water around the surface of the mass before it can be assimilated by the cement. As a preventive measure, moist earth or

Fig. 8—Completely unitized unit in the Clay City field of Illinois, showing entire unit and sampson resting on steel beams set on concrete floor. Note substantial steel foundations under unit

occasional sprays of water will assist in preventing such cracks.

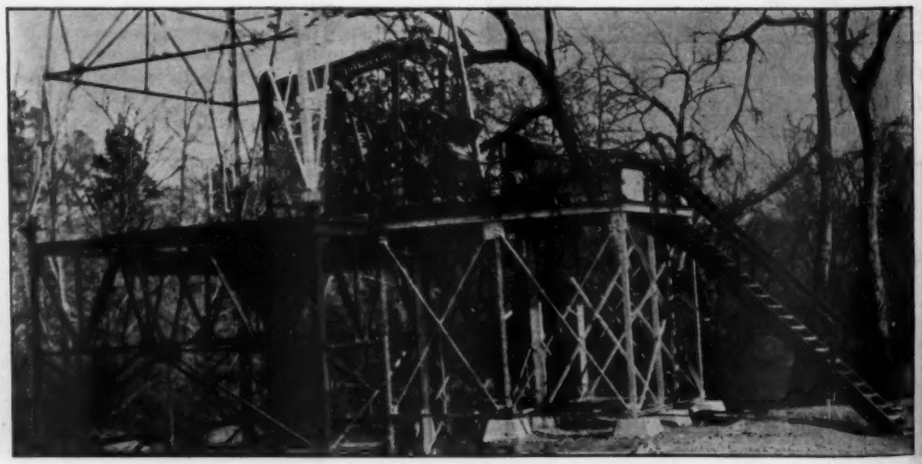
Permissible mixing time depends upon several variables which may occur in the mixture, but, generally speaking, cement should be mixed no longer than necessary to bring about a thorough mix of the cement, water, sand, and gravel. Mixing too long causes the action between water and cement to be partially complete before concrete is in the forms. Too short a mixing time does not give close enough contact or bond between the cement, water, and aggregate.

Operation of Beardmore Stage Lift in Mid-Continent

The Beardmore stage lift was developed around the intermittent gas-lift principle. The assembly consists of a full string of tubing on which a section of larger pipe, usually 5-inch, is run. The 5-inch pipe extends about 600 feet above the lower end of the tubing. A packer is set near the bottom of the casing to pack off the space between the casing and the 5-inch. The 5-inch pipe extends below the packer nearly to bottom, and at its lower end is a valve which will allow oil and gas to come into the pipe but will not permit high-pressure gas to be injected into the formation. Above this foot valve is another valve which is spring-backed and serves to open and close a passage between the tubing and "stage chamber." The "stage chamber" is the space between the 5-inch pipe and the casing. A bypass around the spring-backed valve serves to conduct part of the gas from the tubing down to a point just above the foot valve, where it is jetted to lift the oil coming through the foot valve. This jet does not lift the oil to the surface but drops it into the stage chamber. When the stage chamber and part of the inner chamber become filled with oil, an intermitter at the surface introduces high-pressure gas into the tubing. The pressure opens the spring-backed valve, and the gas enters the stage chamber, forcing the oil out ahead of it. At the same time, the high-pressure gas issuing from the lower jet discharges the oil from the inner chamber so that the fluid from both chambers is carried to the surface. When the high-pressure gas is introduced, the foot valve in the device closes to prevent gas or oil from escaping into the formation.

The surface intermitter may be used in two different ways when a Beardmore stage lift is in the hole. Usually a short flow of gas is introduced between the regular flows in order to fill the stage chamber. For example, the gas may be shut off for 15 minutes while the inner chamber fills with oil. Then a one-minute flow of gas may be admitted by the timing mechanism in order to remove the oil from the inner chamber and drop it into the stage chamber. After another 15-minute shutdown used for the inner chamber to refill, a six-minute flow of gas may be used to lift the oil from both chambers to the surface. Sometimes the short gas flow is not used.

One of the largest jacks in Oklahoma. The front is supported on tubular posts running to bottom of cellar



Elevated steel foundations have been required in low lands. This installation is located in the Sabine River bottoms in East Texas which is often under water

BACKSIDE CRANK PUMPING

(Continued from Page 91)

and anticipated pumping time of each the same, no counterweight will be required.

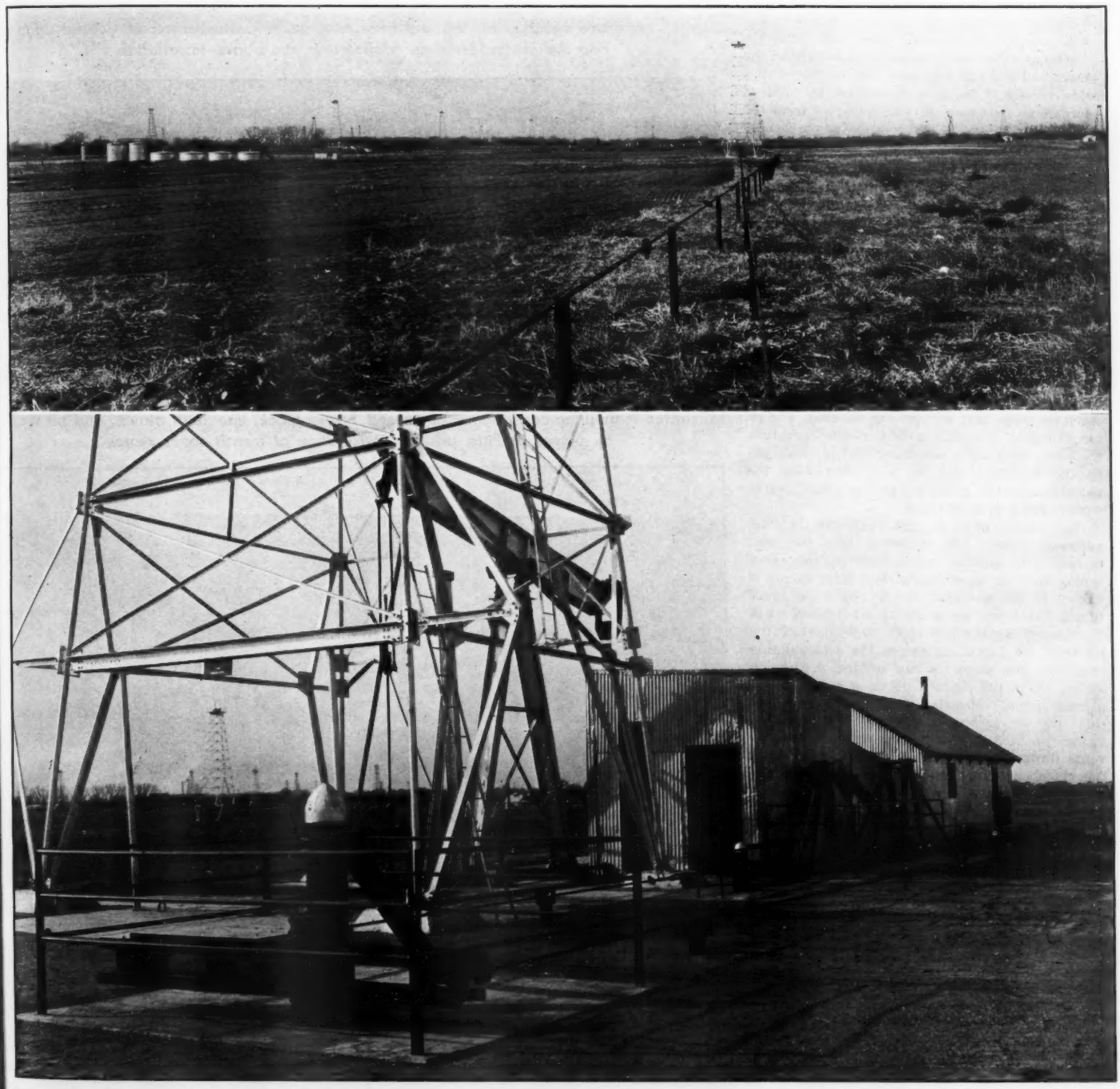
Theoretically, the only power that should be required for a properly balanced assembly is that for lifting the fluid and overcoming friction and inertia of the moving parts in the transmission system. In some installations which approach complete balance, it is possible to slide the wrist pin connections on the pin at almost any point in the cycle, which is certainly indicative of a well-balanced setting.

Balance presents a more variable problem on leases where fluid levels vary during each pumping day or period. Such variations mean that although at the beginning of pumping operations the unit is in balance, after the weight of certain wells has been decreased by lowering the fluid level, the system becomes out of balance. Also, it may be necessary to unhook one well from the system after a few hours to prevent pounding and subsequent damage to subsurface equipment. This condition has been met in the manufacture of two-way stroke posts by placing sufficient iron counterweight on top of the post beam, and providing some arrangement, either crank, wheel or gear, so that the pumper alone can slide the weight along the beam with ease, and adjust the balance of the installation as often as any appreciable change takes place. The old style method of hooking rod-line onto dummy weight when a well is taken off is also effective in maintaining balance under that condition, but did not adjust for changing well weights during the pumping period.

In laying out backside installations, local topographical conditions come in for serious consideration. Wherever possible, the power setting is located at a central point that requires a minimum of rod-line deflection and paraphernalia, by avoiding buildings, trees, lowlands or hills, or other irregular ground conditions. Wide well spacing in some fields is presenting a limitation upon heavy-duty rod-lines needed in backside cranking, unless made in comparatively level country.

Offers Flexible Method

Backside cranking offers a more flexible method of pumping than either the individual units or central powers. Individual rigs are often needed



Two views of same installation. In the lower picture may be seen the center well which is pumped directly by the beam, while two additional wells are pumped with backside crank. The latter wells are balanced against each other through the swing shown in the foreground. From this swing the rod-lines go to the two wells shown in the upper picture. Note the rod-lines cross to permit a direct pull

to lift the flush volumes in the well's early life, which could not be lifted through the limited cycle afforded from central powers, but could be through the greater range of cycles afforded by the crank arrangement.

Range of pumping cycles are from 24- to 44-inch strokes except in unusual cases. Speeds are limited by the ability of rod-lines to withstand the rapid changes in their reciprocating motion. The usual larger and shorter rod-lines on backside crank settings permit faster speeds over central powers.

The backside cranks themselves are made of extra heavy steel. While generally carried in stock with three holes for stroke ranges (say 30, 36 and 42 s.p.m.) they may be obtained on special order for slower or faster strokes. A multiplier post, either hanging from the top (pendulum type) or anchored at the bottom, may be set on any rod-line to permit variations in pumping cycle between wells pumping off the same power unit. They are so arranged that tie-on connections, both from the power end and the well end, may be placed in a wide variety of holes to accomplish the desired increase or reduction in cycle imparted from the power unit. Likewise, different cycles on each of the two, three or four wells may be arranged to suit each individual well.

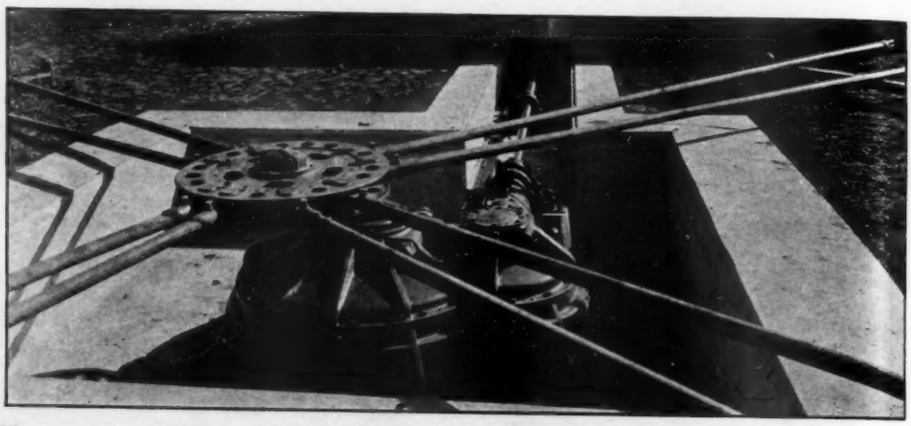
Gas Displaces Oil from Chamber To Lift Oil in Small Wells

The Philneumatic pump was designed for wells which practically have reached the pumping stage. It is essentially a bottom-hole valve arrangement used to displace oil from an accumulating chamber with high-pressure gas, thus lifting a series of slugs of oil and gas which are delivered to the surface through tubing. Surface equipment for controlling the injection of high-pressure gas consists of a regulator and a cleaner. An intermitter may or may not be used. The intermitting is primarily a bottom-hole operation, the pump alternately admitting high-pressure gas to the chamber, and in turn exhausting the chamber, as the pressure in the input string varies over a 5-pound range.

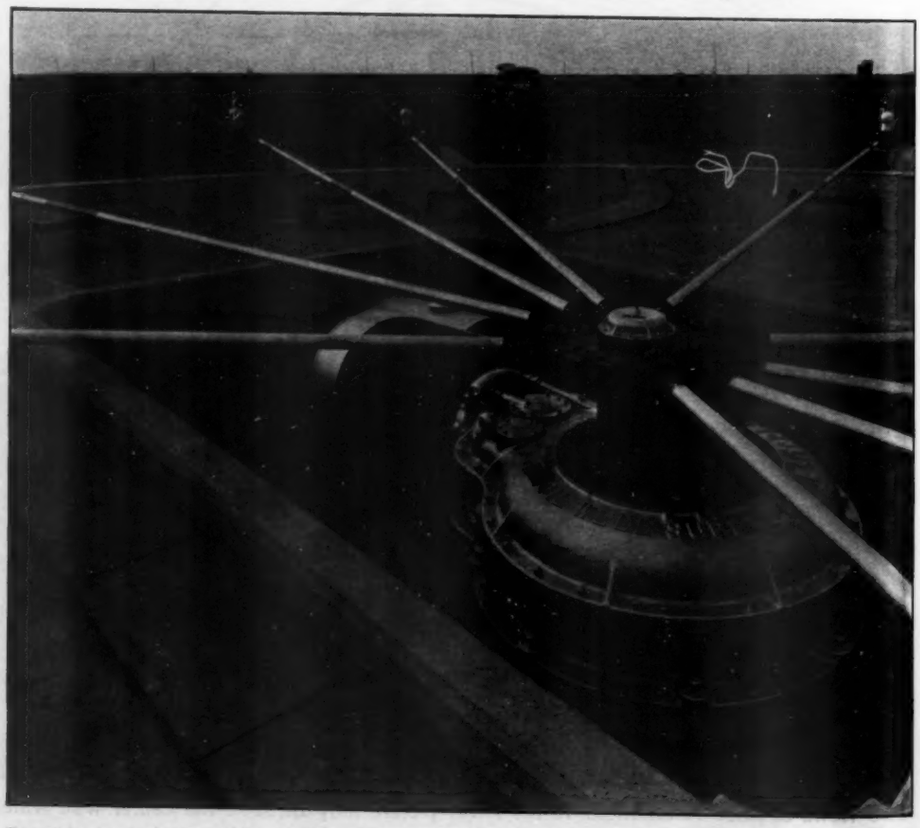
Two strings of tubing are used with the Philneumatic pump. Gas is forced into the well through the annular space between the outer tubing and the inner tubing. The outer tubing is known as the gas-input string, while the inner tubing is the production string. At the bottom of the inner string is a foot valve through which the oil from the formation enters the accumulating chamber. The pump is run on the production string, but at the planned depth of setting it engages a special collar ring in the gas-input string; this ring serves to pack off between the two strings of tubing, and it also provides exhaust vents through which the gas is exhausted from the chamber to the annular space between the casing and the outer string of tubing. This exhaust gas is withdrawn from the casing at the surface by a gasoline-plant vacuum line, thus making it possible to have little or no pressure on the chamber while it is filling with oil.

In operation, a suitable time interval is allowed for the chamber to fill with oil. Then a 5-pound increase in pressure in the input-gas string opens a valve to admit gas into the chamber. The 5-pound pressure increase may be brought about either by a surface intermitter or by a gradual pressure build-up in the string. When the gas displaces the oil from the accumulating chamber it drives it up above a check valve in the top of the chamber. After the oil has been replaced by gas, a pressure-operated valve uncovers the exhaust ports to discharge the gas from the chamber into the casing annulus, and a new cycle begins. The well's productivity is the most important consideration in determining a suitable length of cycle.

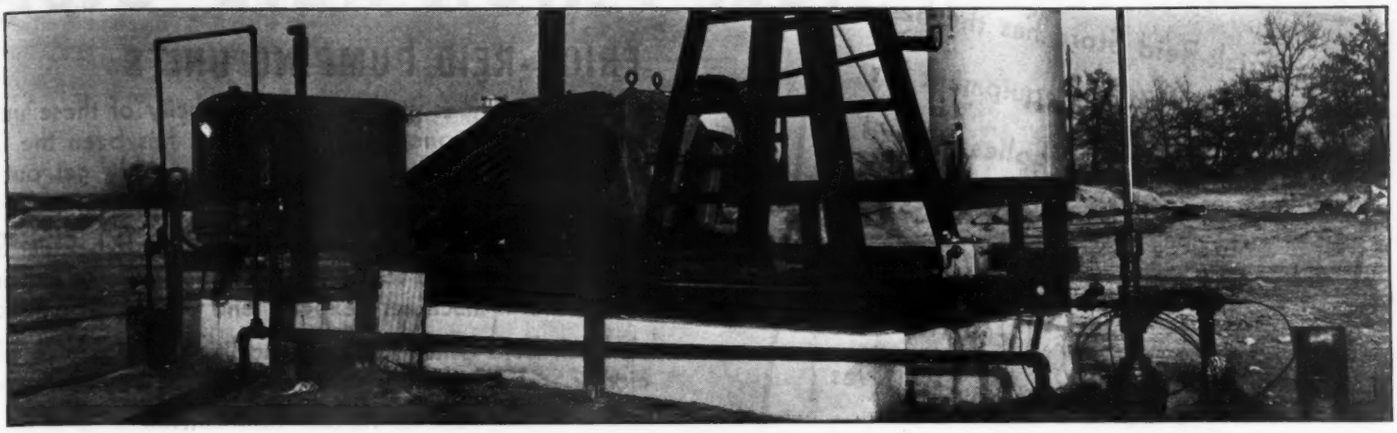
Simple, one-piece concrete foundations may often serve central-powered, geared units set on the ground-level as is shown in the above installation



Illustrates monolithic construction of geared power block, line shaft trench, and pit walls, on power at Fitts, prior to installation of trench cover plates



Beauty can sometimes be built into as simple a thing as a concrete foundation. Here is shown a geared power at McCamey, Texas. Note the stairs and circled walkways



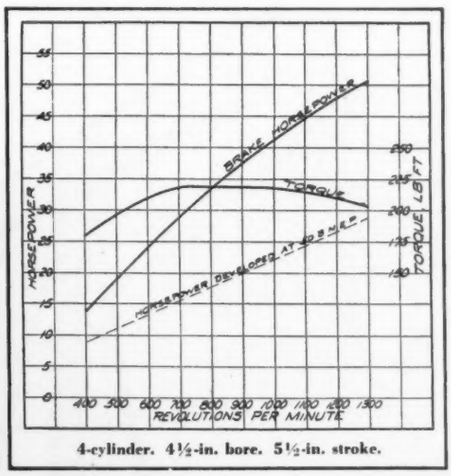
Fifty-horsepower four-cylinder gas engine driving single-crank geared unit

Pumping Units Powered by Oil and Gas Engines Find Favor

Multi-cylinder gas and gasoline engines are used for many purposes by the oil industry. Other industries have long recognized the advantages of this form of prime mover but conditions in the oil-fields have made adaptation of this type of unit rather slow. This statement is particularly true for the production of oil. However, the success attained by the hundreds of installations made in recent years is leading to wider application of multi-cylinder engines to production problems and this type of engine is being used not only for direct drive for pumping units but for direct connection to generators of relatively small size used to develop electric power for individual lease requirements.

There are many problems confronting the operator in the selection of a power unit for a pumping well. Economy is one of the prime factors and is influenced by the proper selection of the right size of power unit for the particular job. If the engine is too small the maintenance and repair costs will be high. If the engine is too large the higher initial investment will increase costs. The proper size of engine is one whose total cost of maintenance, plus depreciation, is lowest.

To select the proper size of engine it is desirable that the power requirements be known. It is not always easy to determine just what the power requirement will be but if the well has been powered it is possible to secure data from the performance of that unit and from such data decide the size of multi-cylinder engine best suited for the work to be performed. For new wells portable pumping units may be used to gather information about power requirements. If such units are not available, data from similar wells may be examined and a unit selected that will



4-cylinder. 4½-in. bore. 5½-in. stroke.

Typical performance curves on multi-cylinder gas engine

Multi-cylinder engine driving pumping equipment on well in Seminole, Oklahoma, field

be a little larger than estimated requirements. If this proves too costly to operate it should be possible later to replace it with a unit that will operate more economically.

Some time ago the operators in southern California, together with the manufacturers of multi-cylinder engines, formed a committee to study field conditions and standardize equipment and methods of determining ratings on engines of this type. This committee was headed by S. H. Grinnell, Union Oil Co., Los Angeles, Calif., and a partial report of the committee's findings was made

(Continued on Page 106)

Your FRICK-REID Store

Your Frick-Reid Store has the best possible production equipment for your area. And the supplies stocked by your Frick-Reid Store are the ones you need from day to day. The demands and peculiarities of your area are studied constantly as the local basis for Frick-Reid service. We overlook no opportunity to be helpful, for much of our business hinges on what successful producers think about our co-operation.

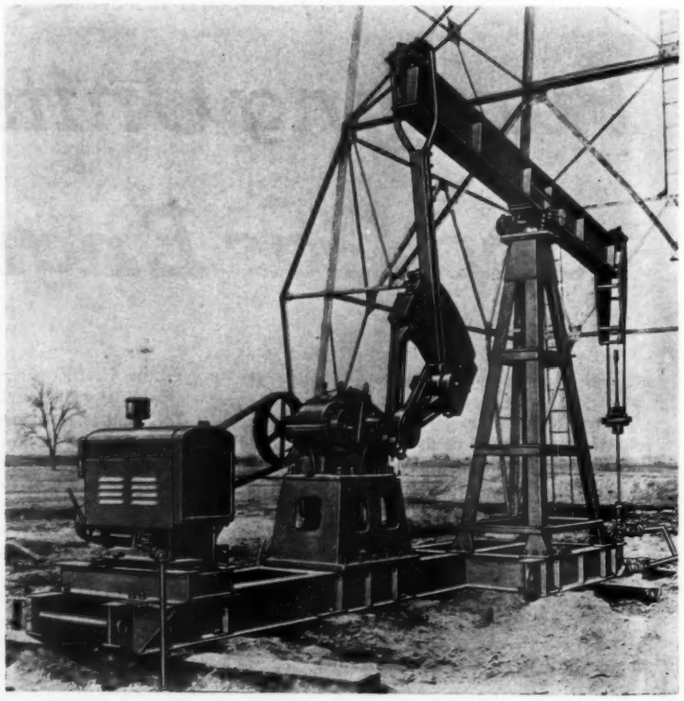
FRICK-REID PUMPING UNITS

Note the obvious strength and simplicity of these units. Dependable, economical performance has been the first consideration. There is nothing to readily get out of order.

Each unit is provided with Foote Brothers IXL Gear Reducer best adapted to the load and your choice of prime movers. Our machinery experts lend every co-operation.

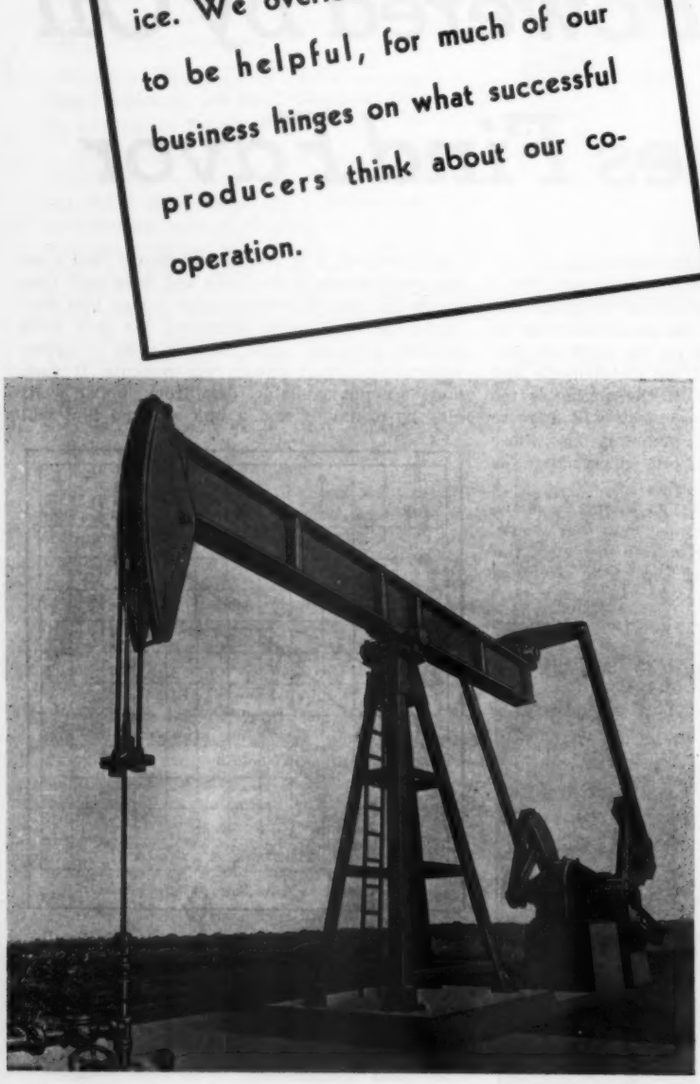
A Frick-Reid Unit will handle additional wells with efficiency and economy by means of a back crank assembly.

Ask for further information.



FRICK-REID PUMPING UNIT
(Jr. Model)

Operating at twenty 54" strokes per minute. 2900' well equipped with 2½" tubing. Note the heavy underframe, which makes it practical to set the unit on a derrick floor or rig timbers. Maximum portability. Low installation cost. A shaft extension is provided on the Foote Brothers IXL gear box for pumping additional wells from a back side crank.



FRICK-REID PUMPING UNIT
(Model 17-74)

This Frick-Reid 17-74 Unit is pumping from 3000' through 2½" tubing at a speed of eighteen 74" strokes per minute. A permanent installation on concrete, although this unit can be had with structural steel underframe at nominal additional cost. Equipped with Foote Brothers IXL single or double reduction gears, for use with any prime mover.

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REID BANDWHEEL PUMPING POWERS

Reid Bandwheel Powers are recognized as the most dependable units for multiple well pumping. Many have been in continuous service for over twenty years.

Reid Geared and Bandwheel Pumping Powers are the standard of the industry. Their efficiency is unrivaled.

REID ENGINES

Joseph Reid built his first successful oil field gas engine in 1894. Reid engines of all kinds are now used and preferred in every branch of the oil industry. They are particularly well adapted to beam well operation and central pumping power drive.

Ask for Bulletin No. 80 on the new REID Twin Vertical Gas Engine

Two REID Bandwheel Powers under construction in East Texas

A REID Engine going in

Below—a finished job—dependable, economical

AXELSON SUCKER RODS

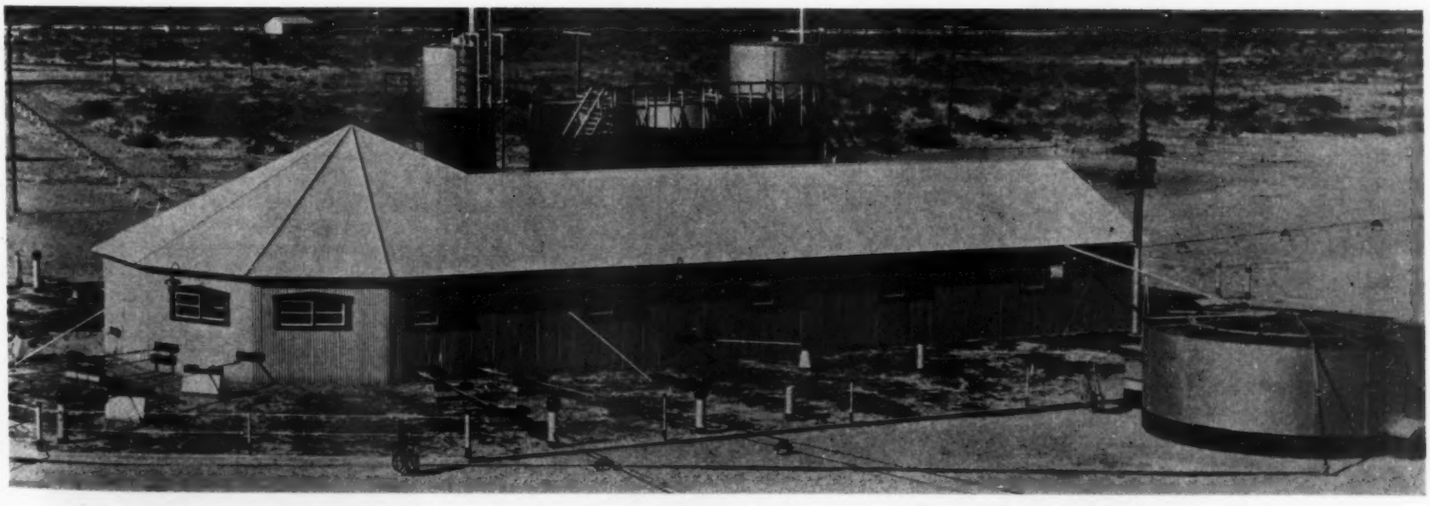
No. 55—Medium carbon steel. Normalized from end to end after forging, but before threading. Excellent service under normal pumping conditions.

No. 60—High grade carbon-manganese steel, fully normalized from end to end after forging, but before threading. Uniformly high strength, ductility and shock-resisting values. For average to heavy pumping.

No. 59—Nickel-molybdenum alloy steel, fully normalized after forging, but before threading. Strength, ductility and shock resistance in excellent combination. For extra heavy loads, and where irregularities in pumping movements are unavoidable. The alloy content discourages corrosion fatigue.

AXELSON PUMPS

Axelson Tubing and Rod Pumps are made for every production problem. Your Frick-Reid Store has the right AXELSON Pumps for your area, along with other AXELSON production equipment and supplies.



PLY CORPORATION

Equipment Suppliers Exclusively — Stores in Old and New Fields

by D. G. Kingman, General Petroleum Corp. of California, Los Angeles, Calif., before the spring meeting of the A.P.I. Division of Production in 1936.

Because of lack of uniformity of test conditions and difference in engine design, performance curves of gas engines are not usually applicable in the selection of engines for oil-field service. Satisfactory ratings will result in long life and low maintenance costs. Such ratings may be based upon a uniform brake mean effective pressure (b.m.e.p.) and piston speed. Values to be used depend upon service to which the engine will be subjected. For steady loads such as centrifugal pumps or compressors, as high as 65 or 70 pounds per square inch b.m.e.p. has proved satisfactory. For pumping wells a b.m.e.p. of 45 or 50 pounds per square inch, based upon the average load, is commonly used. For intermittent service, such as driving shipping pumps or pulling wells, piston speeds as high as 1,200 feet per minute are allowable, while for continuous duty 750 to 1,000 feet per minute is more satisfactory. The rating of an engine based upon 50 pounds b.m.e.p. and 750 feet per minute piston speed is determined by the formula:

$$\text{Hp.} = \frac{ND^2}{4.47}$$

N = number of cylinders.
D = diameter of cylinders, in inches.

The speed, in revolutions per minute, to give

Internal-combustion engines using gas, gasoline or oil for fuel find many applications on pumping units

750 feet per minute piston speed is determined by:

$$\text{R.p.m.} = \frac{4{,}500}{\text{Stroke, in inches.}}$$

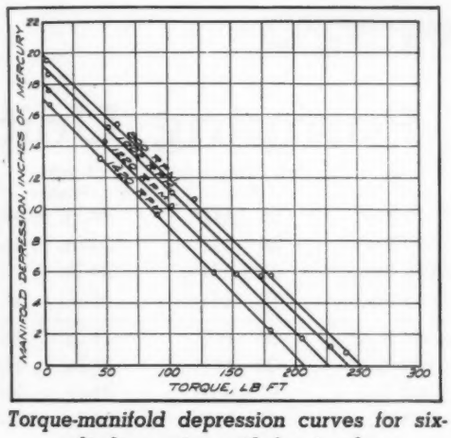
For 70 pounds b.m.e.p. and 1,200 feet per minute piston speed, the rating of the engine is determined by:

$$\text{Hp.} = \frac{ND^2}{2}$$

The speed is determined by:

$$\text{R.p.m.} = \frac{7{,}200}{\text{Strokes, in inches.}}$$

It is a characteristic of gas-engine performance that the torque increases with the speed to some point, but falls off with further increase of speed. It is held by some that an engine should be operated at a speed equal to, or in excess of, that at which maximum torque is developed. If the load then increases and causes the engine to slow down, there will be more torque available to overcome the resistance and the engine will

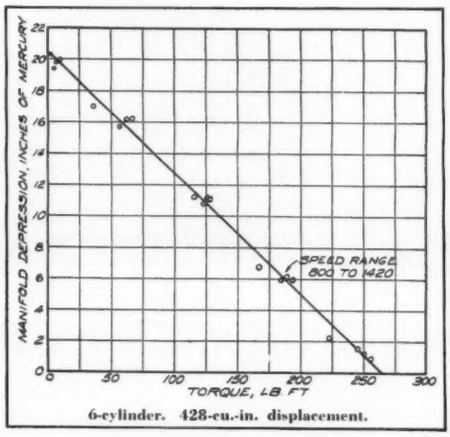


Torque-manifold depression curves for six-cylinder engine with fan in place

continue to operate. If the engine is operated at a speed less than that giving maximum torque, an increase in load, causing the engine to slow down, makes less torque available; and, unless there is sufficient momentum in the machine being driven, the engine will die. The point of maximum torque generally occurs at engine speeds resulting in a piston speed of 750 feet per minute. The accompanying graph illustrates a typical performance for a multi-cylinder gas engine. It illustrates the maximum power the engine can develop at different speeds, and shows the power developed with a b.m.e.p. of 50 pounds per square inch.

Determining Engine Load

To determine the engine load after installation it has been suggested a vacuum gauge be used on the intake manifold of the engine. It has been determined by experiment that, for an engine without fan or water pump, torque develop-



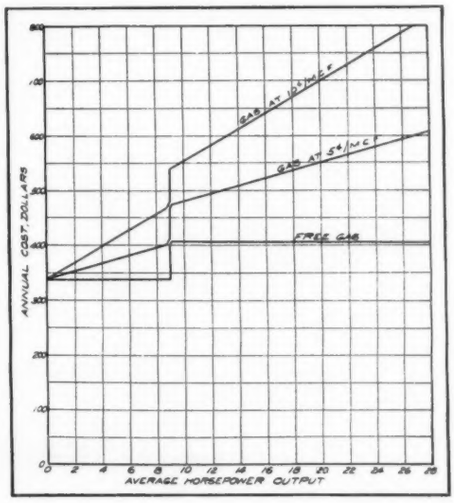
6-cylinder. 428-cu.-in. displacement.

Torque-manifold depression curve for same gas engine with fan removed

ed bears a relationship to manifold depression. For engines equipped with fan and water pump the relationship tends to be linear, but varies with the speed of the engine.

To make such tests a tachometer is used to check speed, and manifold-depression readings are made with a vacuum gauge for different points in the pumping cycle. The V-belts are then removed from the engine sheave, and a torque arm is clamped to this sheave with its free end resting on scales. Torque is applied to the arm by slipping the clutch of the engine. The speed and manifold-depression conditions previously determined from the engine while pumping the well are reproduced, and the resultant torque observed. From these readings, the torque at different points in the pumping cycle is determined.

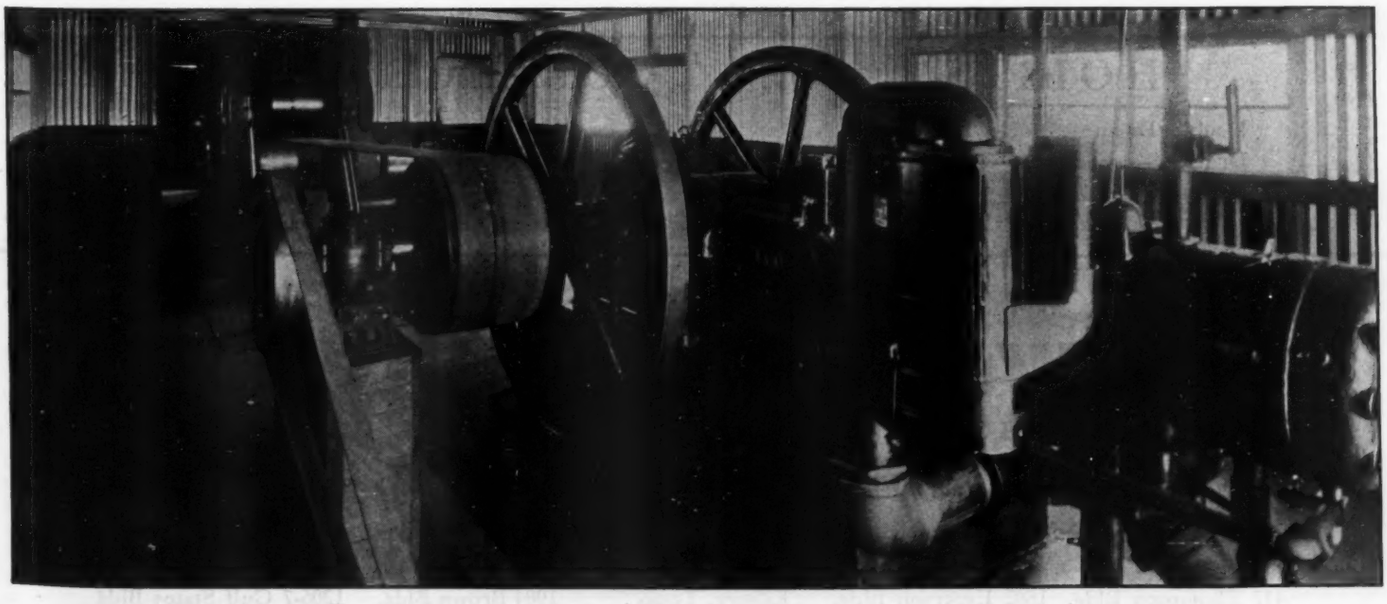
Economy of operation is a desired feature with any power unit used for pumping wells. For gas engines the factors entering into such



Annual cost of operating gas engines at different fuel values

determinations are many and complex. The most obvious costs of gas engine operation are maintenance, oil, repairs, fuel, and depreciation. Maintenance costs will vary with the personnel available and the method adopted. Oil consumption varies with the make of engine, the grade of oil used, and the condition of the engine. Repairs generally result from failure of the engine accessories rather than in the engine itself. Operators rate trouble from the ignition system first, with fan belt trouble second. Failures result from inadequacy of parts, improper maintenance or natural wear.

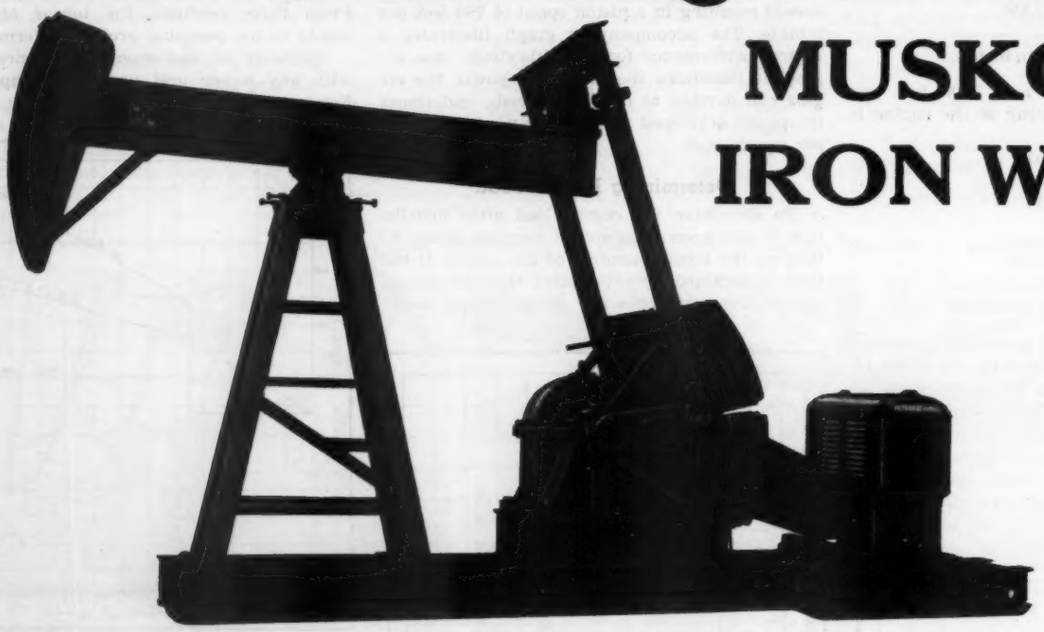
Fuel costs are dependent upon the load, on the engine and the value of fuel gas to the operator. As the load on an engine decreases the fuel requirement per brake-horsepower hour greatly increases. For the part-load conditions under which gas engines generally operate in the



Standard rig-front pumping unit in Chase, Kansas, powered by dual-flywheel single-cylinder engine

PUMPING EQUIPMENT

MUSKOGEE IRON WORKS



Write for Bulletin No. P1

Double Reduction Twin Crank Pumping Units

Unit	Beam Capacity API	Gear Capacity API	Length Strokes
PD4-7	27,500 lbs.	50.3 HP	34-in. to 74-in.
PD4-6	27,500 lbs.	36.8 HP	24-in. to 54-in.
PD4-5	27,500 lbs.	23.2 HP	24-in. to 54-in.
PD3-7	21,000 lbs.	50.3 HP	24-in. to 54-in.
PD3-6	21,000 lbs.	36.8 HP	24-in. to 54-in.
PD3-5	21,000 lbs.	23.2 HP	24-in. to 54-in.
PD2-6	16,000 lbs.	36.8 HP	24-in. to 54-in.
PD2-5	16,000 lbs.	23.2 HP	24-in. to 54-in.

Unit	Beam Capacity API	Gear Capacity API	Length Strokes
PD2A-5B	16,000 lbs.	23 HP	24-in. to 44-in.
PD2A-5A	16,000 lbs.	20 HP	24-in. to 44-in.
PD2A-4	16,000 lbs.	17.8 HP	24-in. to 44-in.
PD2A-4A	16,000 lbs.	15 HP	24-in. to 44-in.
PD1-5B	16,000 lbs.	23 HP	24-in. to 44-in.
PD1-5A	16,000 lbs.	20 HP	24-in. to 44-in.
PD1-4	16,000 lbs.	17.8 HP	24-in. to 44-in.
PD1-4A	16,000 lbs.	15 HP	24-in. to 44-in.

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M.I.W. Pumping Units represent many years of research and design, and are proven by actual field use. Twenty-eight years in the structural steel business — fourteen years experience in building derricks, hoists and other oil field equipment — a staff of highly trained engineers — the application of the practical field experience of oil men — these combine to make possible the engineering achievement of distinctly superior pumping equipment of many unusual features and refinements.

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Stroke Posts — Pumping Jacks — Roller Hold Up — Cranks — Swings — Counter Balanced Stroke Posts

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oil-field, the fuel consumption per horsepower is generally considerably in excess of that shown for full load. Seventeen cubic feet of 1,000 B.t.u. gas per brake-horsepower hour is thought to be representative of average requirements. The value of gas to the operator should be based upon the cost if purchased. If he produces his own gas, it should be valued at whatever it could be sold for. If there is no market for the gas it need not be considered in the cost figures.

Depreciation of Engines

Depreciation of gas engines of the multi-cylinder type is still an unknown factor. Some operators assume a life of four years, while others select ten years.

Annual cost of gas-engine power under continuous operation for different values of gas are plotted in accompanying graph. The curves are based upon the values in the following table:

Expense item—	Amount:
Maintenance and repairs	$0.47 per day
Oil	0.13 per day
Depreciation	4 years—up to 9 hp.
	5 years—up to 9 hp.
Interest, taxes, insurance	9 per cent
Efficiency	15 per cent

The single-cylinder horizontal gas engine has long been a standby for pumping oil wells. The fact that an ample supply of natural gas is usually available on the lease has made this type power unit popular. These engines are made in the two-stroke and four-stroke cycle types and will use gas with fuel values ranging from as low as 500 B.t.u. to as high as 1,500 B.t.u. per 1,000 feet. The two-stroke-cycle engines run at speeds ranging from 180 to 450 r.p.m. without knocking or backfiring.

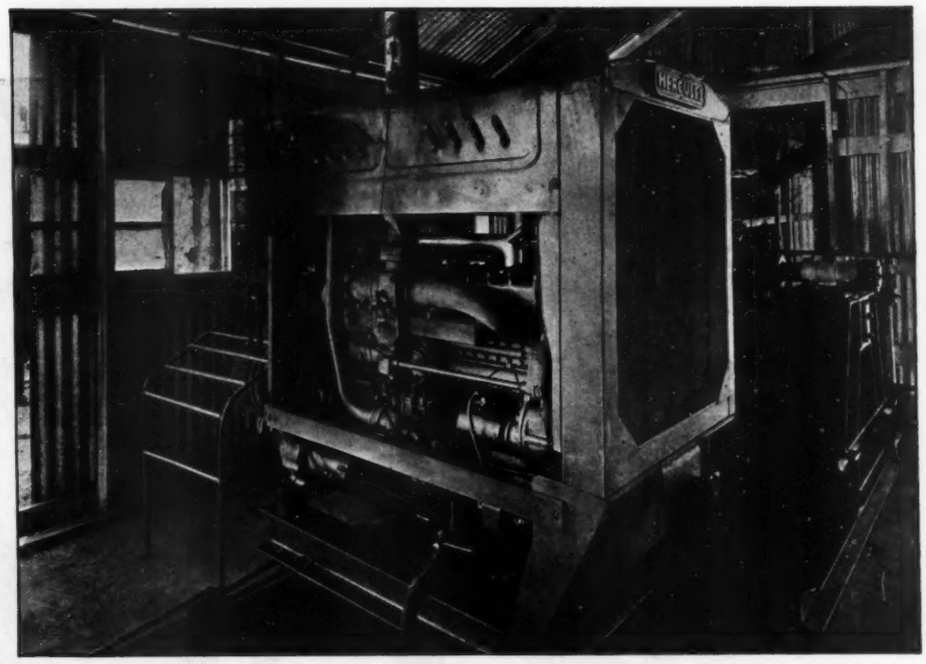
These engines have a wide range of application in the production of oil and have also been used for drilling. To produce oil these engines have been used for swabbing, to drive individual units for pumping, for pumping powers, to drive compressors for airlift and repressuring of oil sands and to drive pumps for water-flooding operations. Because of the range of speed and extreme flexibility the two-stroke-cycle engines have been used extensively for drilling, swabbing, and pumping individual wells, and also to drive pumping powers. However, the four-stroke-cycle engines have won favor for pumping powers in recent years.

Engines rated at 45 brake hp. at 180 r.p.m. have been used for swabbing and raced at speeds of from 450 to 500 r.p.m., developing as much as 90 hp. to furnish power for the peak load in starting and accelerating a swab from the bottom of the trip. This practice has made swabbing costly and it is not as commonly used now. Proration limiting the volume of oil allowed to be produced from wells has also tended to decrease the demand for gas engines for swabbing operations.

Standard Rig Fronts

The standard rig front with bandwheel and walking-beam is still popular in many fields and such units are frequently powered with the horizontal gas engine. The walking-beam speed varies from 20 to 35 strokes per minute and the length of stroke will vary from 24 to 60 inches, making a rather desirable arrangement for the gas-engine drive. When the standard rig front pumping unit is used it is common practice to retain the bull-wheel for servicing the well.

For repressuring partially depleted oil sands the gas engine is used to drive a compressor either by direct connection or by belt. The air is forced into the input wells at from 60 to over 200 pounds per square-inch pressure and it may be necessary to continue to deliver gas or air into the formation for a long period of time before increased rate of production is observed at the oil wells. The four-stroke-cycle engines seem to be preferred for com-



Large-capacity radiator as part of engine driving pumping unit in Oklahoma City area

Four-well back-side crank enclosed in house

Forty-horsepower gas engine in Haven, Kansas field

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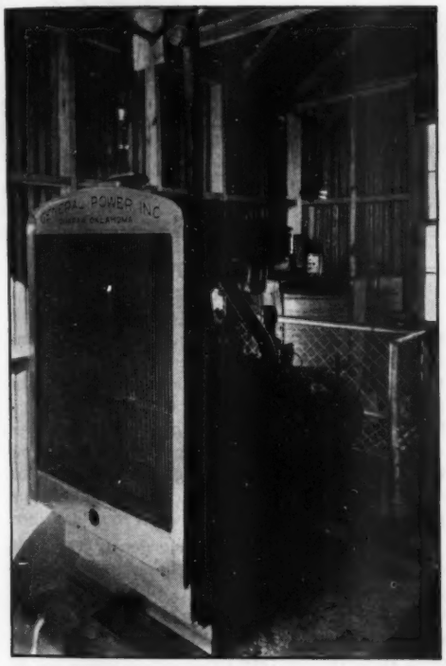
Largest European Makers of
Production Equiment.

pressor drive because the load is evenly distributed because a constant volume and pressure of gas or air is desired and the four-stroke-cycle engine operates best under constant-load conditions.

Horizontal gas engines of the four-cycle type in sizes ranging from 25 to 100 hp. have been used to drive pumps for water-flooding. This is another type of constant service and well suited to the characteristics of the gas engine.

In fields where the producing sand is relatively shallow it has long been common practice to use central pumping powers to operate the pump jacks at the wells. These powers consist of a gear or wheel supported by a vertical shaft and revolving in a horizontal plane. The hub is attached to eccentrics which act as cranks revolving horizontally and in this manner imparting a reciprocating motion to the rodlines extending from the central power to the wells. The number of wells pumped by one central power may vary through a wide range. There are instances where over 40 wells have been successfully pumped by a central



Eight-cylinder automobile-type engine on pumping well near Ada, Okla.

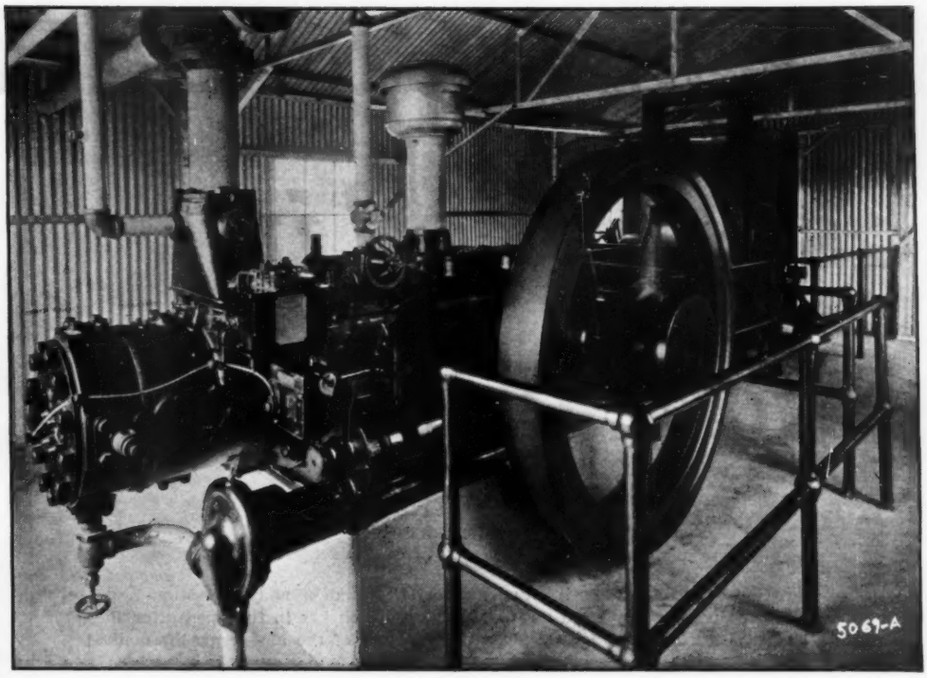
power. Wells as deep as 4,200 feet have been produced by this system also.

The modern gas engine has low fuel consumption. The super two-cycle or a good four-cycle engine requires about 10 cubic feet of 1,000 B.t.u. gas fuel at full load. The older type two-cycle engines required from 13 to 16 cubic feet per horsepower per hour of gas of the same heat value.

Engine Efficiency

The greater efficiency lies in direct transmission of power to the compressor cylinder in the gas engine compressor units. The total overall efficiency is 80 per cent for the average machine of this type. Direct compressor drive also lightens the loads on the crankpin and main bearings.

This type of engine is conservatively rated for both piston speed and m.e.p. (mean effective pressure). Piston speed is usually between 630 and 700 feet per minute and this aids in low maintenance costs. The mean effective pressure on the two-cycle engines ranges from 48 to 52 pounds per square inch and on the four-cycle engines from 65 to 70 pounds per square inch.



Single fly-wheel type horizontal gas engine used in Fitts, Oklahoma, pool

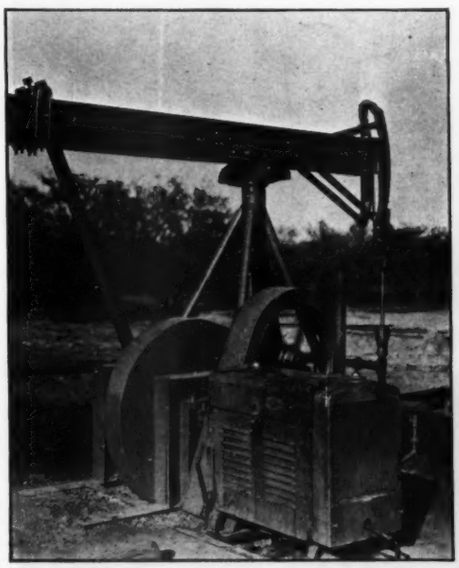
The term m.e.p. is from the horsepower formula:

$$\frac{\text{PLAN}}{33{,}000}$$

where:

P = Mean effective pressure, or m.e.p.
L = Stroke in feet.
A = Area of piston in square inches.
N = Number of explosions per minute.

In four-cycle engines, N = r.p.m. × number of cylinders ÷ 2. In a two-cycle engine, N = r.p.m. × the number of cylinders.

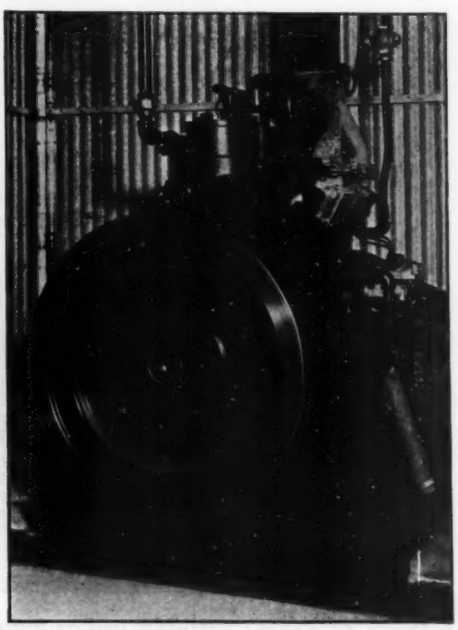


Shallow-well pump powered by small engine

From this formula it will be seen that m.e.p. is the average pressure on the piston during the power stroke. The term of "brake" is used when computing the brake horsepower or the output at the engine shaft, taking into consideration the friction losses in the engine itself. The actual mean effective pressure in the cylinder will be somewhat higher than the brake m.e.p., but is, of course, not all available for actual work. A good four-cycle engine will, when in good condition, develop brake m.e.p.'s of from 88 to 100 pounds per square inch, but if the engine is rated at its maximum it has no overhead capacity and cannot maintain this output for any considerable period.

An average rating is 70-75 pounds per square inch as this rating gives a 10 to 18 per cent overload capacity that can be maintained for short periods without danger to the engine. The lower the m.e.p. rating the longer the life and the lower the maintenance.

Piston speeds in excess of 1,050 feet per minute are not advisable for continued service. Piston speed equals stroke in inches × speed in r.p.m. × 2 ÷ 12.



Vertical engine used on well in Lisbon, La.

Modern Gas-Lift Practices as Applied in Mid-Continent

By R. R. KYNER
Chief Engineer, Gas Lift Corp.

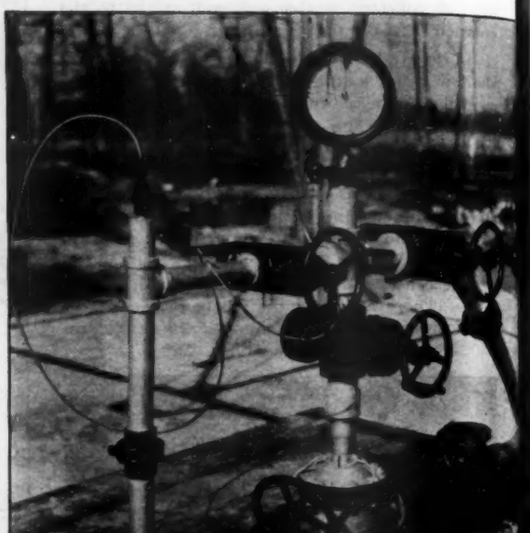


Fig. 1—Showing streamlined gas-lift hookup as employed in the Rodessa field

Gas- or air-lift, old as it actually is, as a method of producing oil, has had a rather spasmodic existence. Until the past several years the dependability, or perhaps, the feasibility as a method has been questioned, and many operators have regarded it as a purely intermediate stage between the flush flowing life and the accepted ultimate pumping stage.

Gas-lift has come into its rightful place in the oil industry with the advent of the proration and subsequent curtailment of production, followed by immediate curtailment of expenditures.

The basic principles and theory of gas-lift remain unchanged. However, its progress has heretofore been retarded due to the inherent variables in its application and by the lack of complete information. The advancement of the oil industry has made possible the determination of both the static and flowing bottom-hole pressures, the productivity index and formational gas-oil ratios, which has in turn permitted the advancement of the air- or gas-lift method.

The writer has outlined the method, and the improvements that exist today, and gratefully acknowledges the valuable assistance given by the pioneers in the art.

Gas- or air-lift at one time covered the field, but the development of numerous mechanical devices makes it necessary to differentiate between the variations of the original application.

Straight gas-air lift, hereinafter termed gas-lift, is intended to mean the use of tubing and casing only, viz.: an oil eductor tube and a gas conduit. Pressure is applied to the annulus between the casing and tubing, and when sufficient pressure is created the fluid U-tubes to the surface, followed by the breaking through of the gas. At this point aeration takes place and the column in the tubing is lightened, creating a differential between the two pressures, thereby establishing flow. The complete aeration of the flowing column results in a lower operating or casing pressure. The same method is followed in flowing through the annulus between casing and tubing. However, this has often been resorted to for starting or kickoff purposes only; and then reversed back to tubing flow.

The starting or static submergence (the vertical distance in feet between the static fluid level and the bottom of the tubing) in most instances, has been governed by the ratio of casing and tubing sizes and the starting or kickoff pressure available. However, in rare cases the productivity or ability of the well to produce governed the placement of the tubing, viz.: when the eductor tube is placed at a point at which the flow from the well equals the capacity of said tube, it is unnecessary and impractical to go deeper.

Bearing in mind that swabbing was the means most frequently used for determining the productivity of a potential gas-lift well, it is readily seen that many variables did exist, and the choice of flow strings was in final analysis a matter of trial and error. No one will contend the efficiency of straight gas-lift under ideal conditions, but the aforementioned lack of information, and the rapid changes due to capacity flowing have made such a condition rare indeed.

The very fact that in the past gas-lift wells were flowing at capacity (which was the primary reason for the choice of the method) either resulted in inefficiency or frequent changes of tubing design. Obviously either of these increased operating cost, and thus made it imperative that gas-lift systems be paid out in from 12 to 18 months.

During the period of straight gas-lift, many foot pieces or flow nozzles were designed, but for the most part proved ineffective. The greatest good accomplished by the advocates of the method was the proper design of surface equipment tending

(Continued on Page 119)

A 150-hp. two-stage compressor unit as installed in a station on the W. L. Pickens lease in the East Mountain area of East Texas

to eliminate friction. The discoveries in this connection are as important today as then, but unfortunately are sometimes overlooked.

The formula for determining the quantity of gas required to lift fluid to a given height, is as follows:

$$Q = \frac{8.35 \times L}{144 \times 14.7 \times \log. \frac{P_1}{14.7}} = \frac{L}{254 \times \log. \frac{P_1}{14.7}}$$

Where

Q = Number of cubic feet of air to raise 1 gallon of water to height L.
L = Lift in feet.
P_1 = Absolute pressure in pounds per square inch at the bottom of the eductor tube.

Table 2 indicates the quantity of gas necessary for a wide range of pressure and depths. Based upon 100 per cent efficiency it affords a convenient check for gas-lift operations. Velocity charts (Figures 10-A to 10-H) are included in this report for reference. The efficiency ranges are indicated, and the velocities at the point of entry of the gas, or in straight gas-lift the bottom of the tubing.

The average velocity for oil or water will vary from approximately 10 to 15 feet per second. All gas-lift is dependent upon the submergence and the establishment of the necessary velocity. A flow string, having a capacity greater than the productivity of the well loses submergence and results in a spraying condition. Changes to smaller tubing increase friction with a subsequent increase in back-pressure against the sand and a lower flowing sand-face differential results in retarded production. Pipe capacities and capacities of the annulus between the various sizes of tubing and casing are included in this report (see Tables 1; 3, 3-A, and 3-B; 4 and 4-A).

Efficiencies of straight gas-lift vary from 10 to 35 per cent, averaging approximately 10 per cent. Changes in productivity in many instances demanded more frequent tubing changes than were economically possible. A great number of serious attempts have been made to overcome the apparent

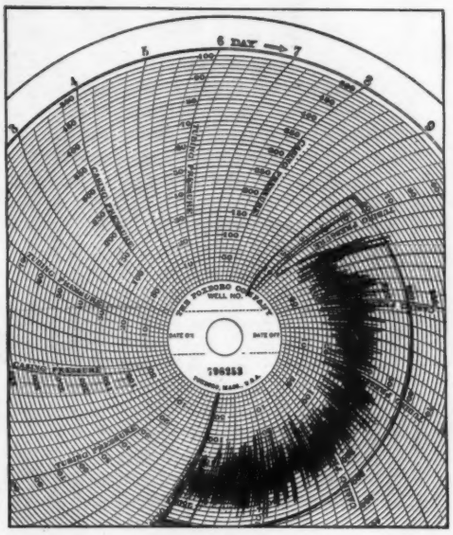


Fig. 3—Three-hour flow chart for tubing installation of conventional valves

obstacles of the straight gas-lift method. A portion of the major ones are listed below:

1. Streamline well-head hook-ups.
2. Two-way well-head hook-ups.
3. Elevated traps.
4. Tapered strings.
5. Tubing-heads readily adaptable to gas-lift operations.
6. Volume controllers.
7. Accumulation chambers.
8. Surface intermitters.
9. Packers and standing valves.

Streamline hook-ups will always be important since their purpose is to decrease frictional resistance and conserve horsepower. The same applies to the elimination of right-angle turns in the flow line, as well as a flow line of ample size. Figure 1 illustrates a satisfactory design of well-head hook-up. The by-pass may be of smaller diameter, when used for equalization purposes only. Elevated traps are now passe for economic reasons. Lower allowables per well necessitate lower investment.

A great deal of experimental work was done with tapered strings to cut down velocities and friction. Theoretically, the idea is sound but was found to be rather uneconomical and impractical. Suitable tubing heads are now quite common. Tubing heads provided with a tapered bowl, and having the hanger equipped with packing, prove very satisfactory for most gas-lift work. Lower starting pressure has tended to obviate the necessity of the blowout preventer combination.

Volume controllers used in connection with a common feeder or header were a great aid in saving input gas. Through experiment the maximum production rates were determined, injecting increased volumes of gas until the created resistance retarded production. From this point the input volumes were reduced until the minimum was determined. Adjusting the controllers to maintain that amount with constant pressure was relatively simple.

As bottom-hole pressures declined, fluid level receded and accumulation chambers became necessary. Chambers have been in use for many years and were designed to permit the maximum accumulation of fluid per foot of static head. Upon displacement of the fluid from the chamber (preferably into a small eductor tube, thereby preventing by-passing) an artificial submergence is created. The J.A.T. system was perhaps the most successful method used. Time-cycle controllers or surface intermitters were generally used in conjunction with accumulation chambers. These were adjusted to open the gas inlet at a predetermined time and remain open for a predetermined interval. Some variations of this method are in use at this time.

Packers and standing valves have had rather wide use, with the thought in mind that such an arrangement would relieve the sand from any back-pressure. Actually all it does accomplish, in instances of continuous flow, is the removal of any possibility of reverse flow or repressuring effect at the instant of kickoff. Since back-pressure under continuous flow is a function of the frictional resistance to flow, it is readily seen that the formational pressure must of necessity be sufficient to raise the standing valve or there will be no production. However, packers and standing valves are an absolute necessity for intermittent flow, or in instances in which the casing is used as an accumulation chamber or reservoir.

One of the greatest obstacles that confronted straight gas-lift was the high starting or kickoff pressures. This necessitated an added investment in high-pressure machines, used only for starting

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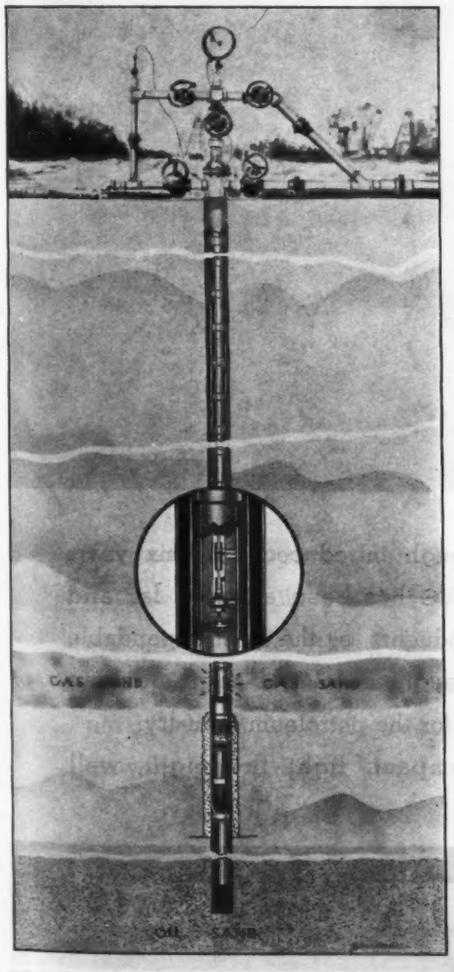

Fig. 2—Double-string conventional type installation using a velocity-type valve

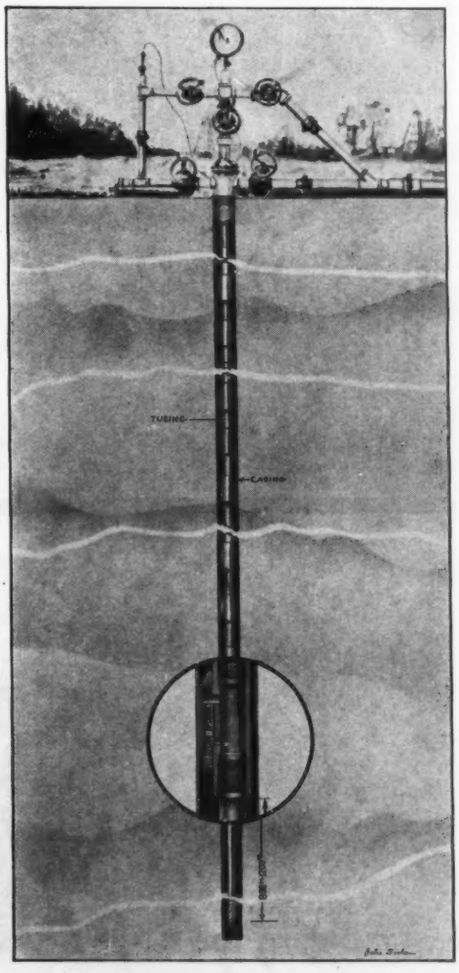

Fig. 4 — Showing S.D.X. long-tail pipe installation used in Rodessa

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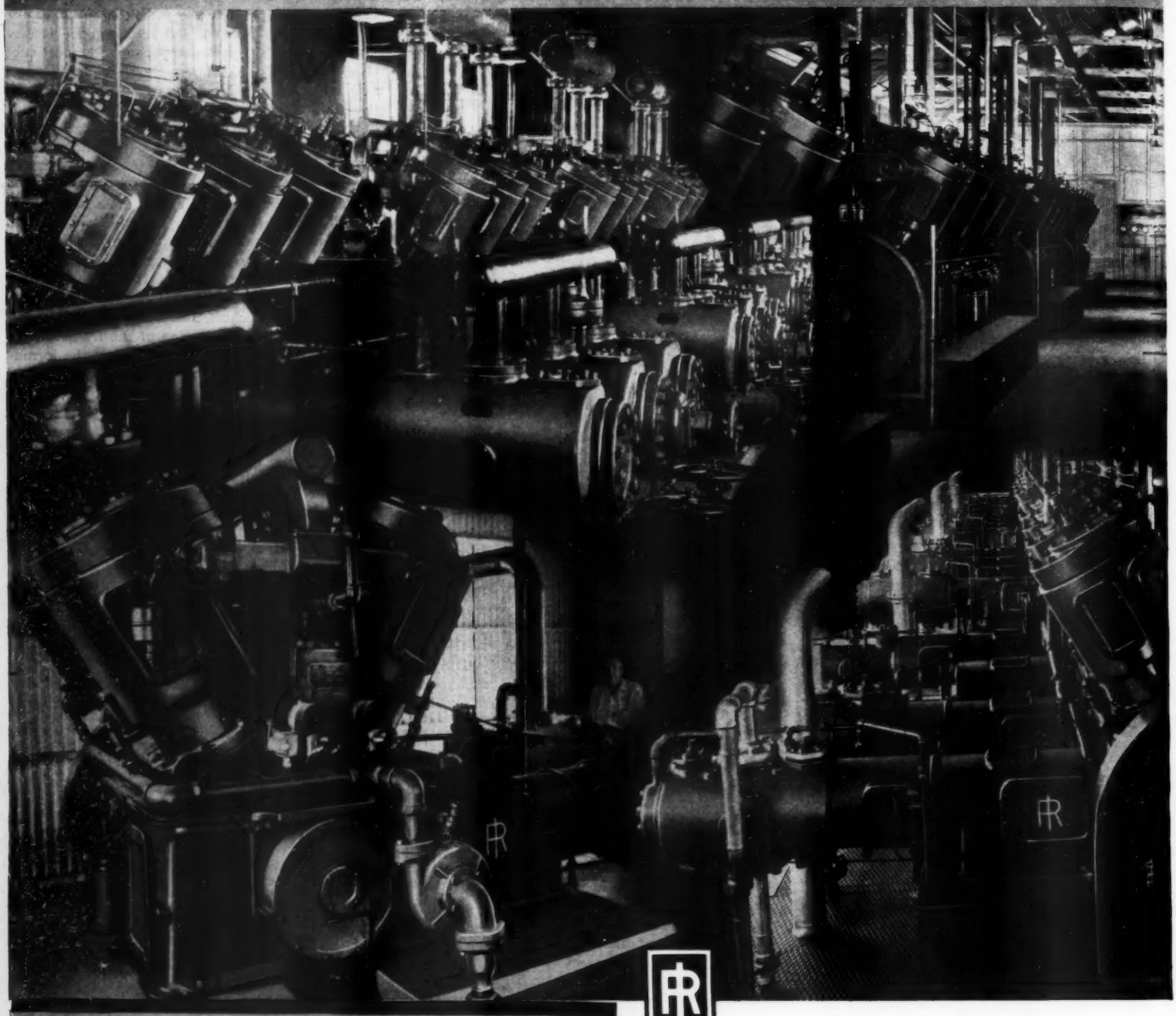

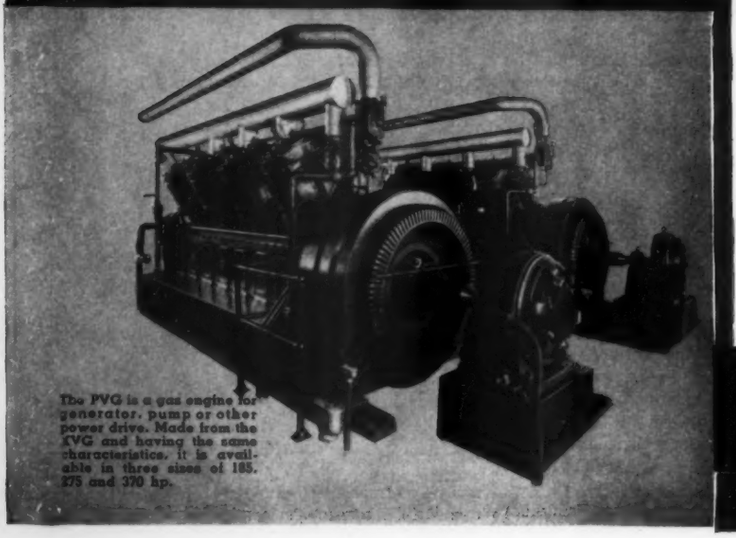

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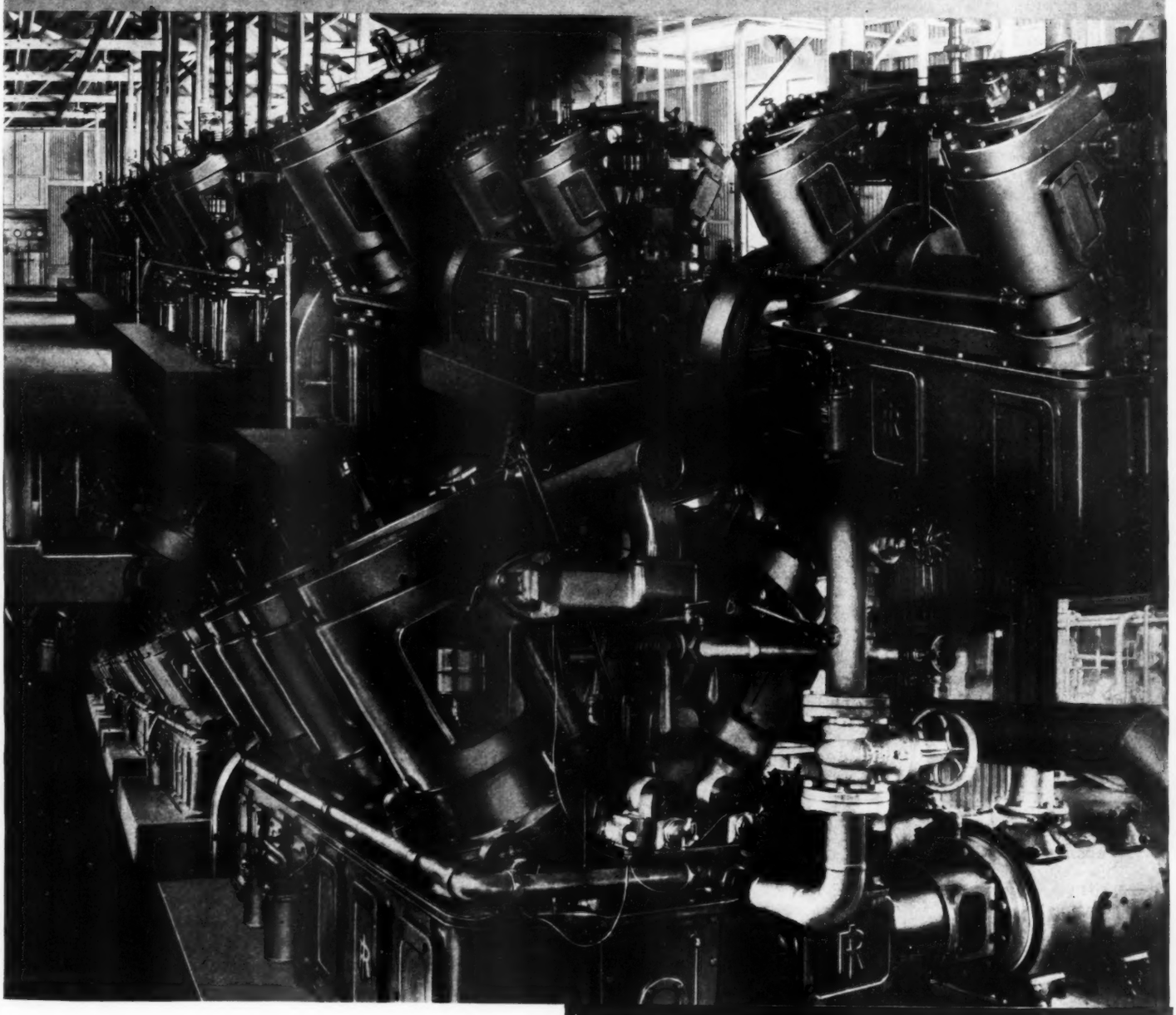

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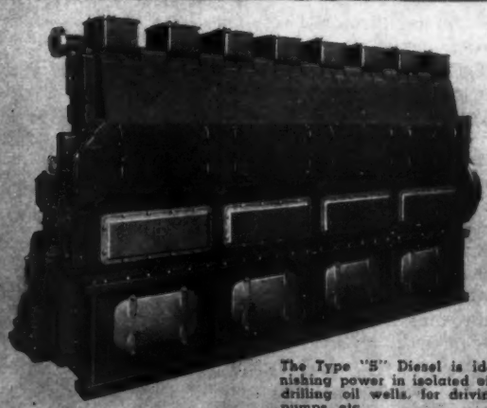

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purposes, or a relatively small portion of the time. Relief from this was first sought through the use of the two-way or reversible well-head hook-up. Unloading was accomplished through the annulus due to the advantage in ratio, and the correspondingly lesser static head.

Ports—Another step in overcoming high starting pressures was the use of ports or various sizes of orifices drilled in the tubing collars. Ports lowered the kickoff pressures readily enough, but obviously continued to remain open after their particular work had been accomplished. Although it is possible to balance the size of this port to the rate of production with a constant input pressure, it many times becomes impractical to do so. Again the variables make an ideal installation today very inefficient tomorrow. Examination of all port or jet collar installations will reveal that their greatest success has been in large wells, or in wells that were producing virtually at the capacity of the flow string.

Kickoff Valves — The disadvantages of open ports made the need of control quite apparent. To fill this need kickoff units or valves were developed. There have been, and still are many, such devices, all accomplishing the purpose for which they were intended. A kickoff valve is exactly what the name implies: it permits the starting of

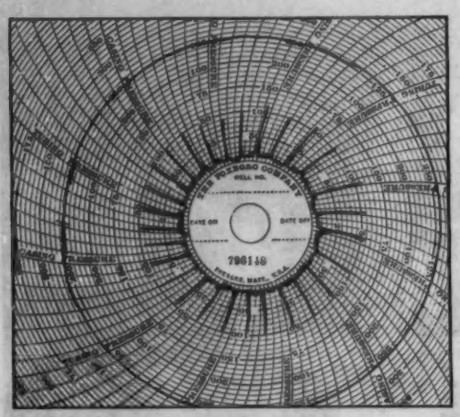
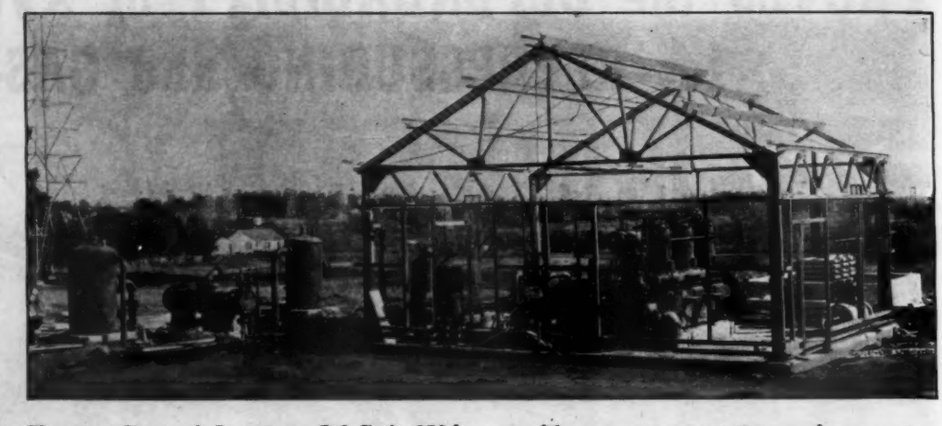


Fig. 5—Fast input flow-meter chart showing opening and delayed closure

a well, and then closes and remains closed during the flowing period.

The gas is eventually injected at one place, around the bottom of the tubing. Should the well fail to start, means are available for the equalization of casing and tubing pressures, permitting the valve to reopen and the operation is repeated. Although this is a manual operation, it was not objectionable in straight gas-lift for the very reason that continuous operation was the ultimate sought for in every installation. Bearing in mind that straight gas-lift was resorted to as a means of increasing production, it is readily seen that shutdowns meant not only lost production for the day but in many instances a decrease in daily rate that never could be regained. The cause of this was the rapid changes in bottom-hole conditions, differentials, flow channels, etc. In summation it may be said that successful installations of kickoff valves neither increased nor decreased the flowing efficiency of a straight gas-lift well.

During the entire time described above, the consensus among the foremost gas-lift engineers substantiated the theory that the most efficient gas-lift operations were obtained by introducing the gas at one point; namely, the bottom of the eductor tube. It is the writer's opinion that this is true when, and only when, the capacity of the eductor tube conforms very closely to the volume of fluid produced.



Showing General American Oil Co.'s 250-hp. gas-lift compressor station under construction in the Kilgore area of the East Texas field

The writer offers no criticism, and intends to reflect nothing but respect to the capable men to whom all gas-lift engineers are indebted. However, from this point the writer wishes to submit a review of work that has been done in the more recent years along a somewhat different line of thought.

The first flow valves, patented as such, came into existence during or after the extensive gas-lift era in the Seminole field. Among the foremost was the Bryan double-balanced velocity-controlled valve. It consists of a stem having two elements, which contact their respective seats simultaneously. These elements are ground into their seats and therefore effect a positive shutoff when in the closed position. Figure 2 indicates the method of operation of this valve.

Originally the valve was intended to open under static conditions by gravity. The closure is accompanied by fluid velocity or the momentum of the fluid lifted. The impact of the fluid against a disc attached to the lower end of the valve makes this possible. Both the valve elements and the seats are machined to precision and the balance carefully calculated. However, during the early experiments the elements were of virtually the same size which eventually presented two problems; the first being the necessity of varying the size of the disc, or using graduated sizes from the top to the bottom of the flow string due to density changes in the flowing column. The second was the fact that under certain conditions of pressure differential between casing and tubing the valve remained in a locked position, either in a closed position or in a semifloating position, similar to the action of a quick-acting float valve.

When the basis of difficulty was determined, experiments were conducted in which the size of the elements were varied, increasing the differential in the downward direction as the valves were placed lower in the flowing column. Velocities at the various points in the tubing were determined by the differential at the respective points. The maximum differential between casing and tubing pressure exists at the top of the flowing column and decreases downward in a straight line. Through the above experiments five slightly varying types of flow valves were developed and the use of a disc of standard size was made possible. These types were not the product of a few short tests, but the results of many years of experiment. The writer is intimately familiar with over 1,200 flow valve installations.

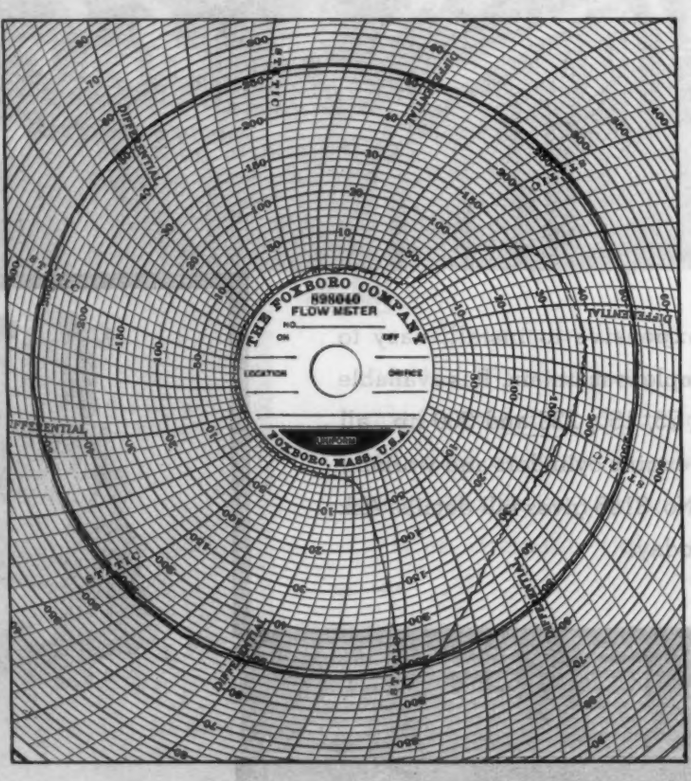
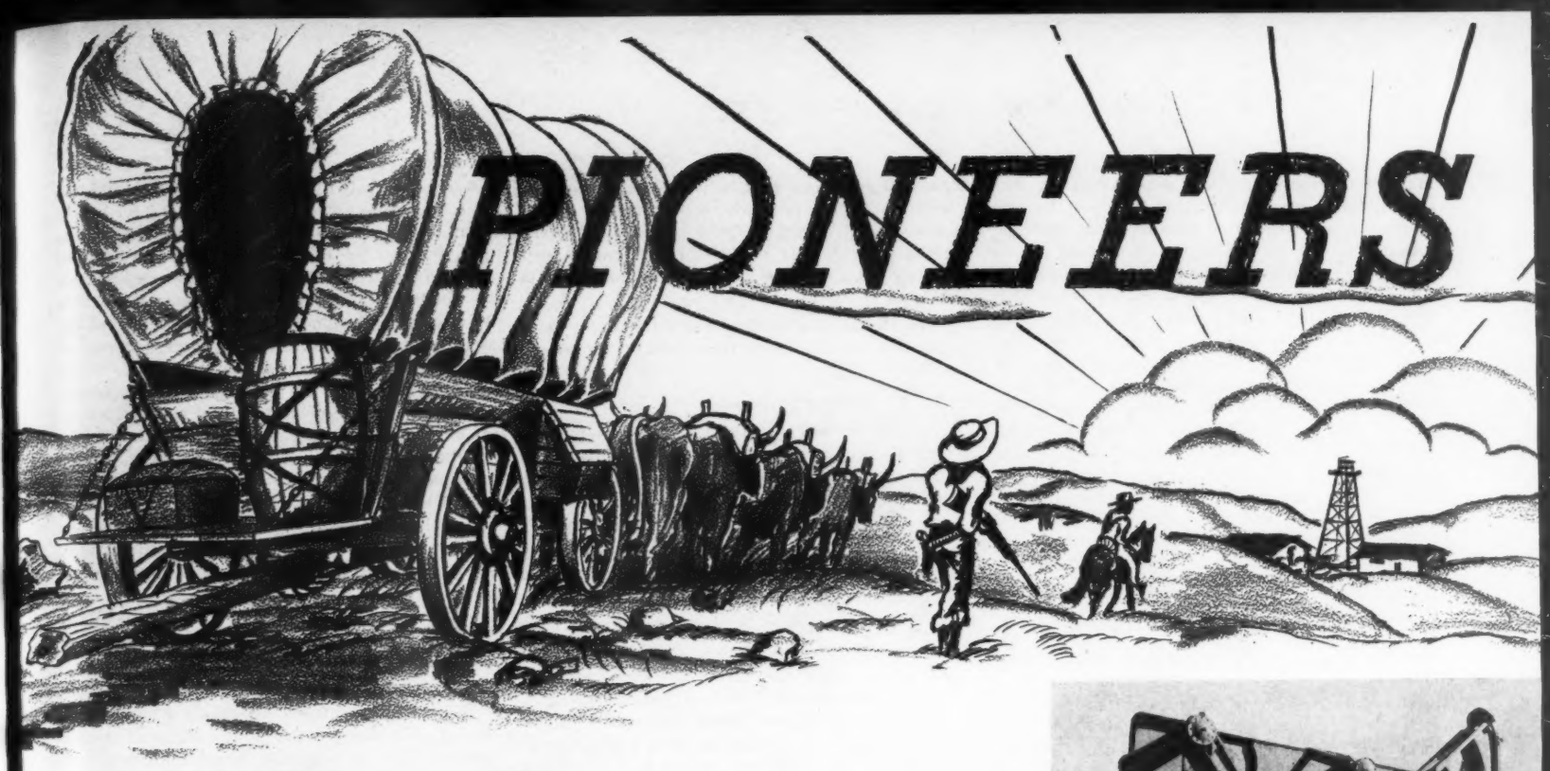


Fig. 6—Tubing chart from S.D.X. installation

The Bryan Type "I" valve is of the velocity type, and necessarily an inside-type valve. Therefore, the matter of clearance is an important one, but due to compact construction a minimum of restriction is obtained. The departure at this time from the original kickoff into a combination kickoff and flow valve tremendously increased the possibilities of gas-lift. The first valve in the flow string is set at, or slightly above, the static fluid level and the remaining spac-



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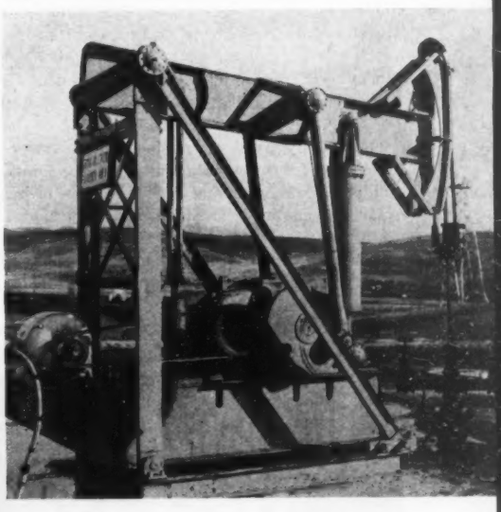

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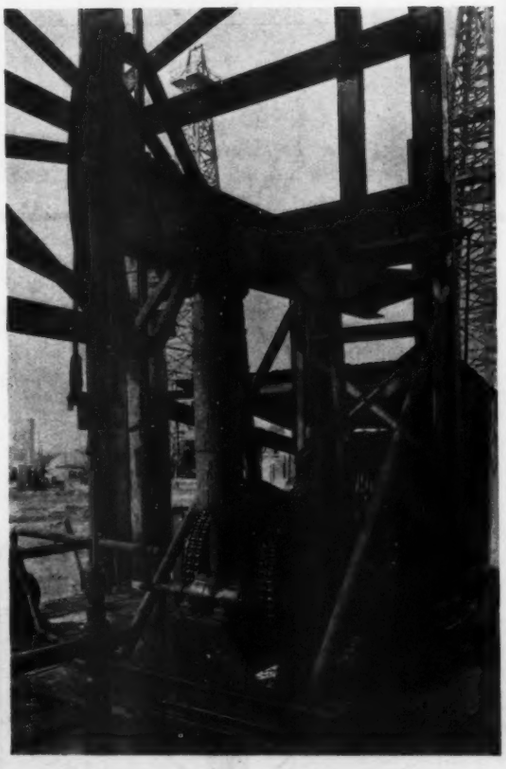

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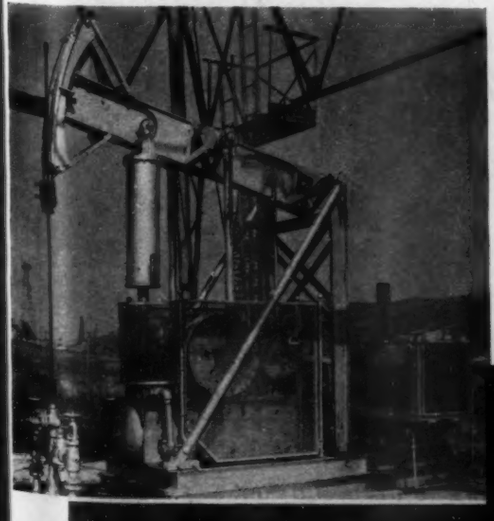

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ings are tapered to the bottom of the string. The spacings average approximately 200 feet. By this method a low kickoff is possible and after the kickoff the valve remains closed as long as the velocity required to close them is maintained. When the flowing velocity decreases below this point they automatically reopen and inject small amounts of gas along the flow string. In actuality they constitute a series of controlled ports that accomplish in conservation of input gas the same as volume controllers have done, except to a greater degree of efficiency. With the use of volume controllers already described it is possible to maintain the volume at a more or less critical point, below which point the well commences to head irregularly, and ultimately dies, or above which the increased friction caused by the entry of additional gas results in retarded production.

Continuous flow by straight gas-lift results for the most part in a constant tubing pressure, due to a uniformly aerated column and constant back pressure. This condition is quite acceptable under ideal conditions, but when the volume of fluid produced decreases it is readily seen that the necessary flowing velocity is being maintained at a loss in over-all efficiency. An examination of the flow chart shown in Figure 3 will reveal that the use of flow valves permits a full opening of the valve followed by a closed period, and a proportional decrease in the volume of consumed input gas. This interval of closure is the measure of increased efficiency over the straight gas-lift method. In final analysis they represent a step forward beyond the maximum of the volume controllers, or a flow in which a controllable pulsating or heading flow is accomplished.

Flow valves permit the prolongation of natural flow, and are being used very successfully in this direction. In instances where proration is prevalent, they fill a very definite need. Flow valves facilitate the starting of the well, and tend to keep it flowing for such periods as formational gas is available.

The Bryan velocity flow valve for tubing flow is particularly adapted to three sets of conditions, as follows:

1. For kickoff purposes.
2. Continuance of natural flow in instances in which the productivity of the well conforms to the size of the eductor tube, or is artificially made to do so by stop-cocking.
3. The reversal or casing flow features.

The benefits of kickoff have been discussed and are self-evident. Their use eliminates the necessity of swabbing or agitation to initiate flow.

The increased efficiency under continuous flow is limited to the elapsed time during the closed periods. The established fact that such a very few wells are flowing under ideal conditions makes this saving an important one. Velocity-type flow valves in no way alter or change the principles of aeration or velocity flow, but should be considered purely as an accessory through the use of which a greater range of adaptability may be obtained, as well as an increased degree of efficiency.

By virtue of the construction of the balanced valve it may be so adjusted, with regard to stem travel, that it will function as a reversible or casing flow valve. By this is meant that the velocity head of the gas effects a shutoff, when entering through the tubing and injecting into the casing. The rapidity with which the closing takes place is governed entirely by the length of travel, and will be found to be surprisingly consistent for a constant set of conditions. These set pressures for the various sizes of casing, have been determined through experiment. Obviously the casing flow system is only desirable or necessary when handling volumes beyond the capacity of the tubing, as in instances of wells making large percentages of water and high total volumes of fluid. Under such circumstances the valve permits a predetermined amount of horsepower to be released accomplishing a given amount of work. Unloading or starting is accomplished from valve to valve, and eventually the well flows from the valve or valves at which the necessary closing differential cannot be reached. The disc is still left intact, thereby making it possible to flow through the tubing until such time as lack of capacity makes the reverse necessary. This feature makes possible the adaptation of flow valves to any straight gas-lift installation. Additional possibilities of this flow valve will be discussed later in this report.

The limitations of continuous straight gas-lift have demanded further development in flowing equipment. Likewise, the extensive use of bottom-hole pressure recorders, in determining well conditions or characteristics, has augmented the necessity of building flowing equipment to accommodate the instrument. Full opening, or outside-type valves, were the answer to this problem.

Full opening through the casting or housing of the valve also permits the use of floats, swabs or paraffin scrapers. However, swabs are necessary only for completion purposes or in instances in which the top-most valve is submerged too deeply.

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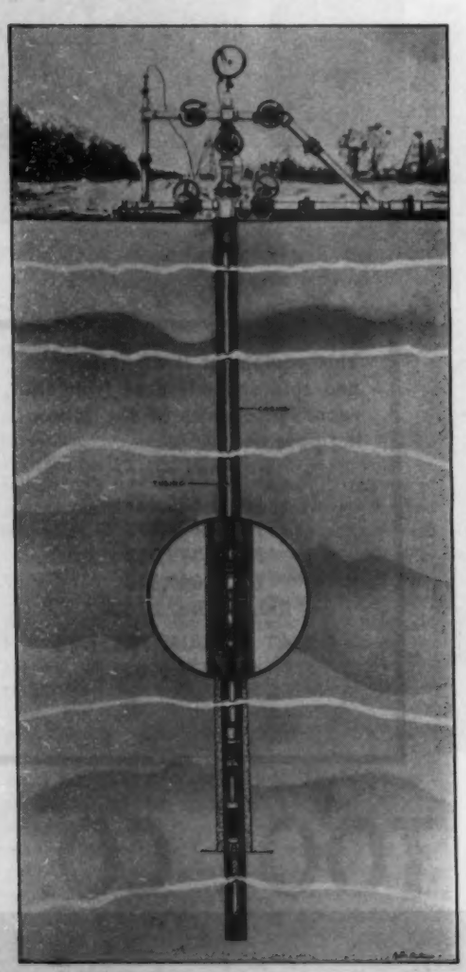


Fig. 7—Well with drop valve above packer

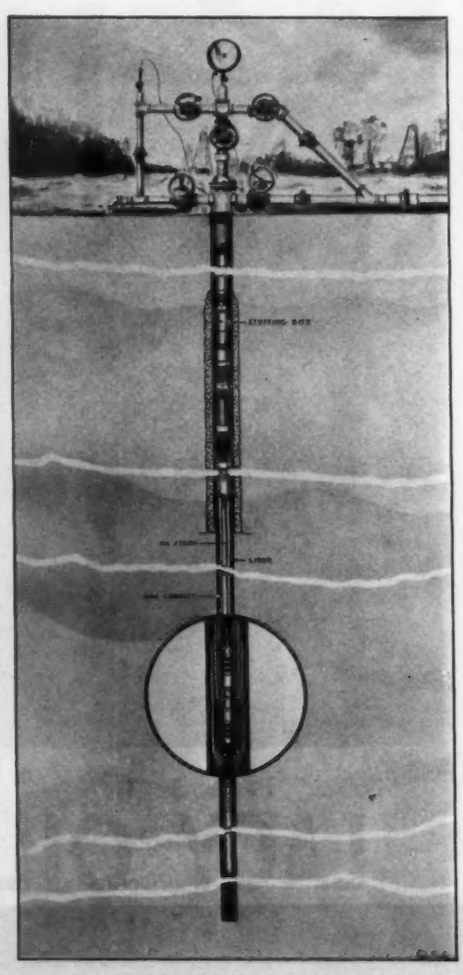


Fig. 8—Well with drop valve below packer

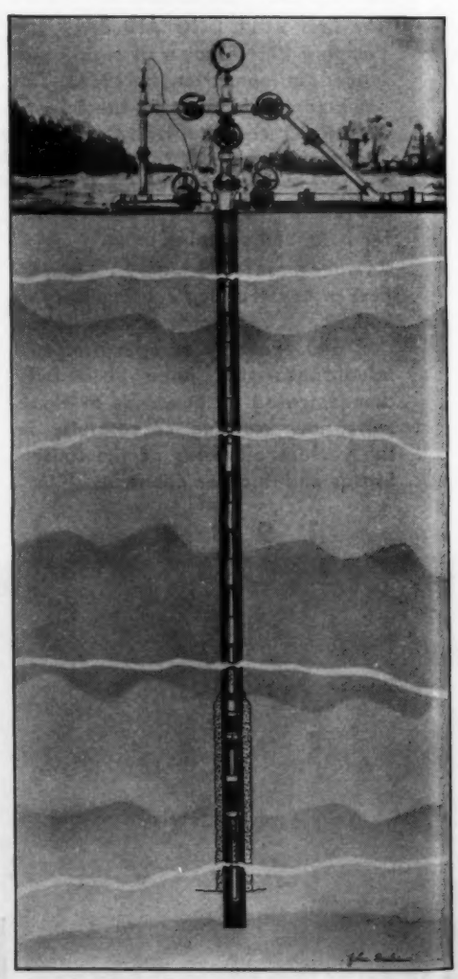


Fig. 9—Typical East Texas installation

The latter being, of course, poor installation practice. Paraffin troubles are not of major concern when the gas is properly controlled.

Numerous types of outside valves have been designed, among which is the Bryan S.D.X. This valve employs the same double-balance principle, or constructional characteristic, as the velocity valve, but is dependent upon differential pressure for opening and upon gas velocity for closure. The upper element in this instance is considerably enlarged to facilitate the closing. However, this is offset to a small degree by a spring which is varied both in tension and in length. The sealing of the valve elements and positive seal are likewise similar to the velocity type. This is an absolute necessity for successful intermitting. The primary purpose of this valve is to construct a valve having potential intermitting possibilities. This commendable purpose presented many difficult problems in that no full successful precedent had been established. Many flowing devices have been constructed that would open with a given differential of pressure, or load, but their weakness lies in the control of the closure. The main purpose of previous valves was not to create intermittent flow, but only to continue the practice of aerating the column.

They also contained objectionable features. In many instances the opening and closing was instantaneous in both directions, or the valve balanced (in much the same manner that a steam engine might stop on dead center) and leakage was permitted. In others that attempted to obtain a sufficient time lag, the mechanism was too complicated to be practical.

Establishing Port Size

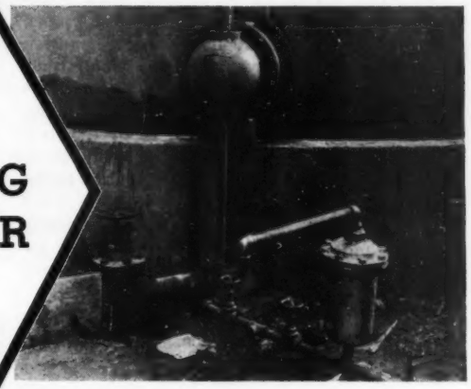
With full realization that both submergence and velocity were still needed, there remained the necessity of establishing the proper port size, set pressure and valve spacing. A great deal of work had already been done in critical flow through a fixed orifice, but the flow in this case was noncritical for a portion of the interval and the very construction of the valve presented additional variables. Therefore, it became a seemingly endless experiment to determine the proper arrangement of ports, settings and spacings. To preclude any possibility of an adverse effect due to the slightest inconsistency in mechanical construction, all valves were tested after being fully assembled. Consequently after a series of experiments, a workable system was established for the aforementioned various conditions.

The first valve in a S.D.X. series, again similar to the velocity type "I," is set at the static fluid level. However, the remaining valves are spaced at equal distances, except in extreme cases. The set reopening pressure controls the spacing. Since the aforementioned purpose of this valve was intermitting it is obvious that to accomplish this it was necessary to have sufficient capacity in each individual valve to flow the well. This is contrary to the theory of operation that had heretofore been considered good practice. Since this was accomplished it is readily seen that a decided advantage has been gained. These valves thus permit a series of submergence percentages controlled by the power applied, or the productivity of the well. They likewise increase the range of adaptability of each eductor tube, or tubing size. For example a 10-bbl.-an-hour well may be produced through 2⅛-inch tubing with efficiencies equaling that of twice or three times the amount with continuous flow. This very feature alone makes this valve a very desirable asset.

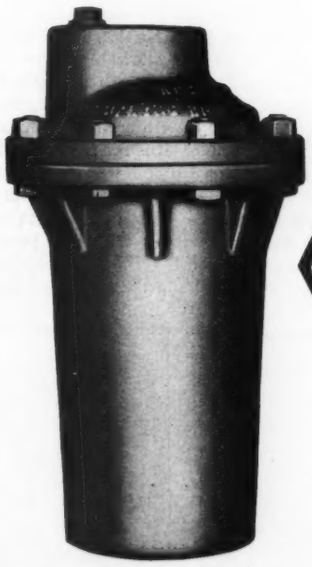
Although the S.D.X. has gained the advantages of intermittent flow, it has retained all of the requisites of a flow valve, wherein it is possible to flow at the capacity of the eductor tube. The set pressure of the valve may be varied to meet many different conditions, including that of a nonreopening or kickoff type valve. This particu-

A 2-Step Program:

1. FOR LOWER PIPE LINE PUMPING COSTS, HEAT YOUR OIL



The above picture shows an Armstrong trap draining a Sims heating unit in an oil storage tank. Various pipe lines are now handling quantities of crude heated up to as much as 180° F. to reduce its viscosity.



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USE THIS TABLE TO ESTIMATE CONDENSATION:

Difference Bet. Steam Temperature and Temperature of Liquid	Pounds of Steam Condensed per Hour per Square Foot of Contact Surface		
	Wrought Iron Coils	Brass Coils	Copper Coils
50° F	5	8	9
100° F	16	25	29
150° F	33	50	57
200° F	55	82	93
300° F	110	165	190

The above table is for making quick approximations only. It is based on an average liquid specific heat of .5 and makes no allowance for viscosity retarding heat transfer or for external heat losses.

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lar type is most adaptable for use in prolonging the natural flow of wells.

All S.D.X. valves are set to open when predetermined load has been established, and stay open until a predetermined amount of work has been accomplished. In this respect they resemble time-cycle controllers, but the frequency of the valve openings is dependent solely upon the productivity of the well, or the valve is actuated by the fluid build-up of the well. The interval of opening, determined by experiment, may be compared to the cartridge of a seltzer bottle, in which a fixed amount of compressed gas is released, containing sufficient horsepower through expansion to remove the load above it. Figure 9 illustrates one type of installation.

Simplicity of design not only makes this operation possible, but permits a consistency and positiveness of operation that are quite essential, A flow chart (Figure 5) taken from an input flow meter illustrates an example of opening and delayed closure. Figure 6 indicates the method of operation of the valve as revealed by the tubing recorder.

Intermitting, as a term, is ordinarily used to indicate the method of flow made necessary when the efficiency of continuous gas-lift has been reduced to an unprofitable point, due to loss of submergence. Since flowing submergence is commensurate with the differential between formational and flowing pressures, it is readily seen that the only method of increase is through the reduction or removal of back-pressure against the formation.

Gas-lift has been carried through this report from an efficient continuous method of operation through varying degrees of intermitting. Each stage has overcome a definite obstacle in the path of the continuance of gas-lift as a method of producing. The transition from one stage to another may be accomplished for the most part by a rearrangement of the original flowing devices. The economic factor has not been overlooked for the reason that efficient operation in every case is intended to mean an economic success, as well as a successful feat of gas-lift engineering. Strictly speaking, intermitting would include only wells of low potential, or strippers, but proration has increased its range of application.

Successful intermitting has been accomplished through the use of the Bryan S.D.X. valve, and the first step beyond that of overcoming inefficient eductor tube sizes is the use of a fluid seal, or long tail pipe (see Figure 4.) This method is especially adaptable to two classes of wells, one having a high bottom-hole pressure but a low productivity index, and the other having a high productivity index and a low allowable. Intermitting is accomplished in both cases by running a series of S.D.X. valves from the fluid level downward to a point that will produce either the maximum of the well or the allowable. (It is the writer's opinion that flow into the bore of oil wells conforms to some extent to the formula governing critical flow of gases. Analysization of accumulated data under the present modern methods will soon prove or disprove this contention.)

The distance from the last valve to the bottom of the tubing must be sufficient to prevent the well from completely unloading or blowing around the end with the available operating pressure. This, in effect, is a fluid packer and remains constant under constant operating pressures. The well is thus unloaded to the last valve, and intermits from that point. This could not be accomplished except for the fact that the valves, as previously stated, have sufficient capacity for flow from each individual valve. Obviously the length of this fluid seal or tail pipe should be proportional to the strength of the well and the operating pressure used.

Closed System Method

When the back-pressure created by the fluid seal in the above method becomes a factor, it may be removed by the use of a packer. This method is known as a closed system and consists of a packer and standing valve above which is placed a valve, or series of valves, through which all input gas must pass. Such an arrangement will permit the pressure to remain on the casing, or in the annulus between casing and tubing, without affecting the rate of production by virtue of the back-pressure. The only requisites in this case are that the well have sufficient strength to build up a head of fluid equal to the necessary submergence for that depth, that the packer has effected a positive seal, and that a constant pressure is maintained.

The greatest reason for intermitting is to increase production or to obtain the maximum. Therefore, continuous operation of the system is

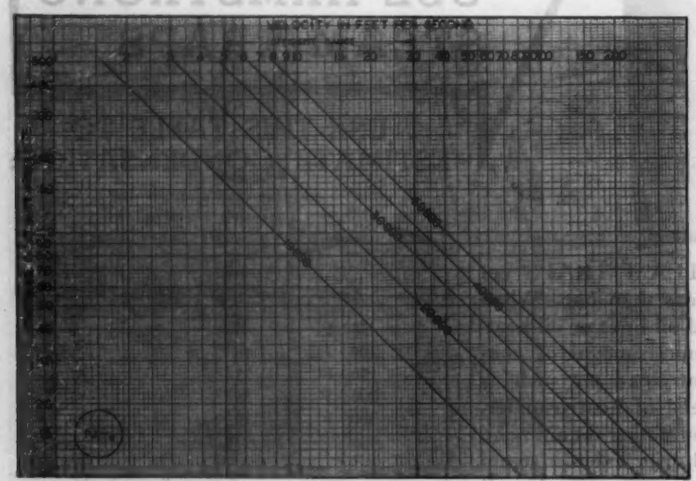


Fig. 10-A

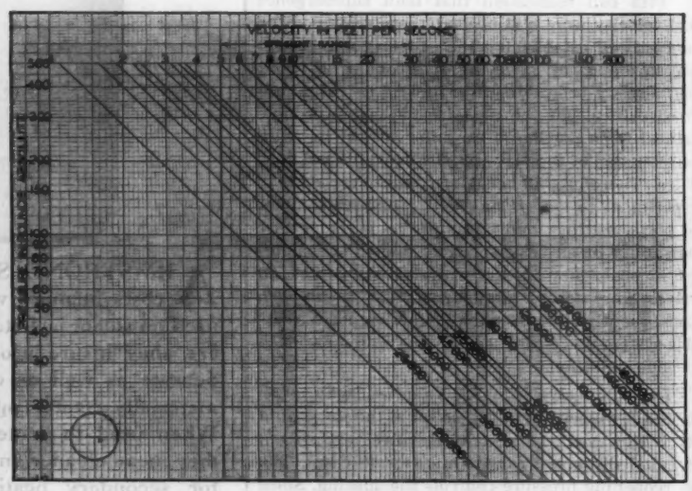


Fig. 10-C

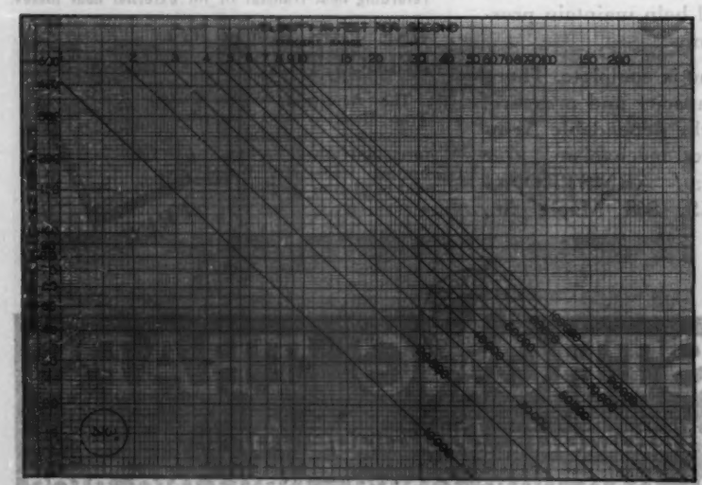


Fig. 10-B

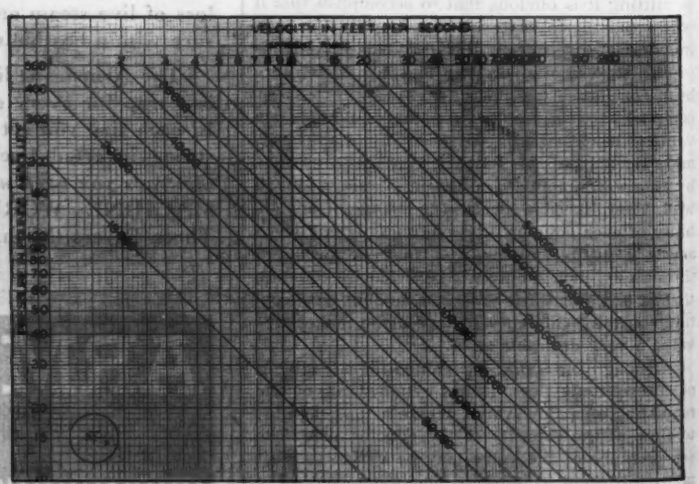
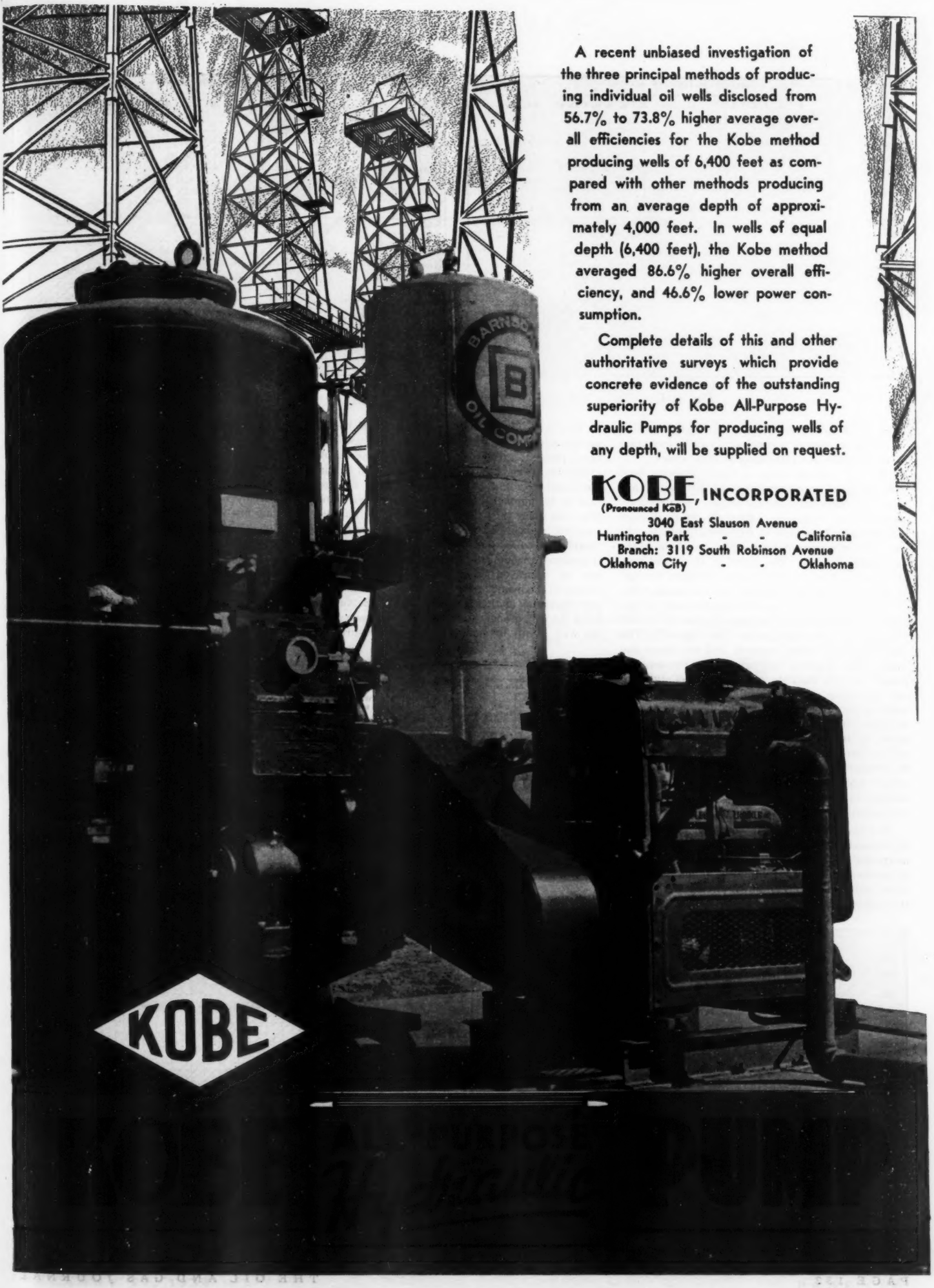


Fig. 10-D



A recent unbiased investigation of the three principal methods of producing individual oil wells disclosed from 56.7% to 73.8% higher average overall efficiencies for the Kobe method producing wells of 6,400 feet as compared with other methods producing from an average depth of approximately 4,000 feet. In wells of equal depth (6,400 feet), the Kobe method averaged 86.6% higher overall efficiency, and 46.6% lower power consumption.

Complete details of this and other authoritative surveys which provide concrete evidence of the outstanding superiority of Kobe All-Purpose Hydraulic Pumps for producing wells of any depth, will be supplied on request.

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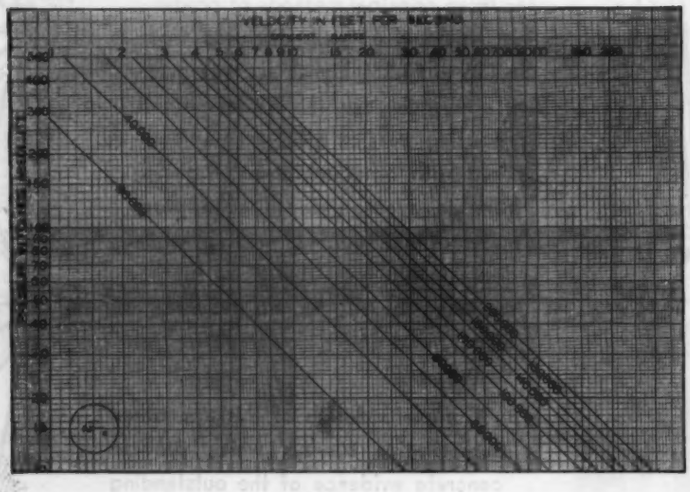


Fig. 10-E

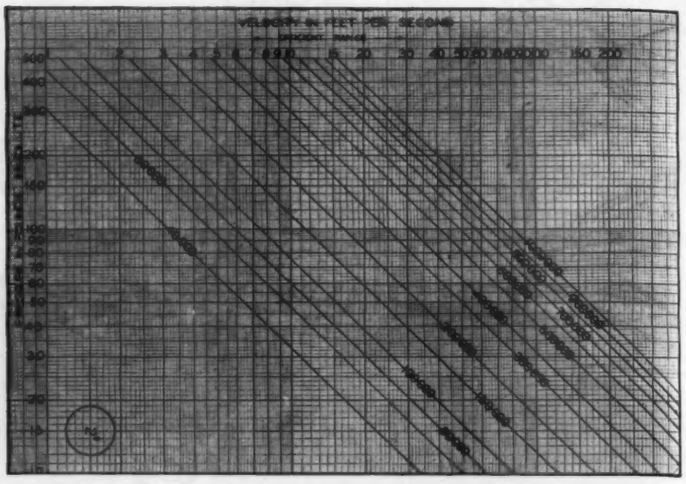


Fig. 10-F

most desirable. Unavoidable shutdowns, because of proration, power failures, etc., can be overcome in the manner described later in this report.

Several arrangements of closed systems have been designed which are fundamentally sound and quite adaptable to practical usage. The Bryan removable-type drop valve presents many distinct advantages. This type of equipment obviates the necessity of expensive tubing jobs, by virtue of the removable feature. The valve is of rugged construction and at the same time is compact enough to be easily handled by a wire line and small tools.

In the first of two possible applications of this valve, a special by-pass seating chamber is located immediately above the packer (see Figure 7). The fluid passes in below, around, and out above the valve. The annulus through which it passes is greater in area than the eductor tube, eliminating any throttling action or tendency to choke or retard the rate of production. The drop unit is held in place in a specially designed liner of monel metal by the expansion of soft leather cups. Release of pressure from the annulus causes the cups to collapse and the removal of the unit is a very simple matter. The fact that the only mechanism subject to wear may be readily removed is of tremendous importance.

The seating chamber is equipped either with or without check valves. However, the inlet ports are protected from foreign matter in both instances by perforated monel metal plates. When using the check valves the well is blown dry before seating the packer, immediately after, and before the valve or drop unit is run. The next step is the testing of the system for leakage through the use of a blind plug. If this proves satisfactory the tubing crew may be released, and the completion of that particular installation and future valve changes may be accomplished by one man with a wire line. The checks in this instance prevent the annulus from filling with oil in the event of a shutdown, thereby avoiding the U-tubing effect when flow is resumed through the tubing. This arrangement may be improved upon by back-pressuring the tubing in the event of forewarned shutdowns. The only essential in this instance is that the tubing valve be leak-proof, thus making it necessary for the well to fill in against the back-pressure exerted by the existing line pressure. This arrangement will definitely take care of all stripper wells.

Another variation of the drop-valve installation is the double-string or below-the-packer type (see Figure 8). This type is necessary in overcoming the disadvantage of large amounts of open hole or long liners. This system is usable in liners having inside diameter as low as 4 inches.

The seating chamber in this case has a female thread for the flow string on the inside and a male thread accommodating the gas conduit on the outside of the upper end. Four small pipes, all of which have sufficient capacity to flow the well are then placed on the inside of the seating chamber at 90-degree intervals. These are connected to a

Tubing Size Nominal	Weight per Ft. Complete	Cross-Sectional Area Sq. In. Internal	** Tubing O.D.	** Coupling O.D.	STYLE	Casing Size O.D.	Weight per Ft. Complete	Internal Area Sq. In.	STYLE	Casing Size O.D.	Weight per Ft. Complete	Internal Area Sq. In.	STYLE	Casing Size O.D.	Weight per Ft. Complete	Internal Area Sq. In.
*1¼"	2.40	1.50	2.16	3.80	A.P.I.	4½"	16.00	13.09	A.P.I.	7"	20.00	32.74	A.P.I.	8¼"	36.00	48.09
									A.P.I.	7"	22.00	32.15	A.P.I.	8¼"	38.00	47.48
1¼"	2.75	2.04	2.84	3.70	Non A.P.I.	5"	15.00	15.26	A.P.I.	7"	24.00	31.53	A.P.I.	8¼"	43.00	45.98
*1½"	2.90	2.04	2.84	4.91	Non A.P.I.	5"	18.00	14.36	A.P.I.	7"	26.00	30.94				
					Non A.P.I.	5"	21.00	13.55					A.P.I.	9"	34.00	53.96
2"	4.00	3.13	4.43	6.47					A.P.I.	7"	28.00	30.33	A.P.I.	9"	38.00	52.76
*2"	4.70	3.13	4.43	7.35	Non A.P.I.	5½"	17.00	18.80	A.P.I.	7"	30.00	29.74	A.P.I.	9"	40.00	52.17
					Non A.P.I.	5½"	20.00	17.93	Non A.P.I.	7"	43.00	25.84	A.P.I.	9"	45.00	50.67
2½"	6.40	4.68	6.49	9.71												
*2½"	6.50	4.68	6.49	10.57	A.P.I.	5⅝"	14.00	21.98	A.P.I.	7⅝"	26.40	38.14	A.P.I.	9⅝"	36.00	62.51
					A.P.I.	5⅝"	17.00	21.16	A.P.I.	7⅝"	29.70	37.12	Non A.P.I.	9⅝"	38.00	62.00
3"	9.30	7.03	9.62	13.85	A.P.I.	5⅝"	19.50	20.35	A.P.I.	7⅝"	33.70	35.94				
*3"	9.30	7.03	9.62	15.93	A.P.I.	5⅝"	22.50	19.86					A.P.I.	9¾"	40.00	61.31
3"	10.30	6.71	9.62	13.85					A.P.I.	8¼"	28.00	44.00	Non A.P.I.	9¾"	42.00	60.81
					A.P.I.	6¼"	20.00	28.73	A.P.I.	8¼"	32.00	42.83	A.P.I.	9¾"	43.50	60.20
3½"	9.50	9.89	12.57	17.72	A.P.I.	6¼"	24.00	27.54	A.P.I.	8¼"	35.50	41.68				
*3½"	11.00	9.49	12.57	19.84	A.P.I.	6¼"	26.00	26.92	A.P.I.	8¼"	39.50	40.55	A.P.I.	10¾"	40.50	79.33
					A.P.I.	6¼"	28.00	26.34					A.P.I.	10¾"	45.50	77.76
4"	12.60	12.30	15.90	21.37					A.P.I.	8¼"	28.00	50.48	A.P.I.	10¾"	51.00	76.20
*4"	12.75	12.30	15.90	24.31					A.P.I.	8¼"	32.00	49.28	A.P.I.	10¾"	55.00	74.82

Table 1—Cross-sectional area of tubing and casing data for use in gas-lift calculations

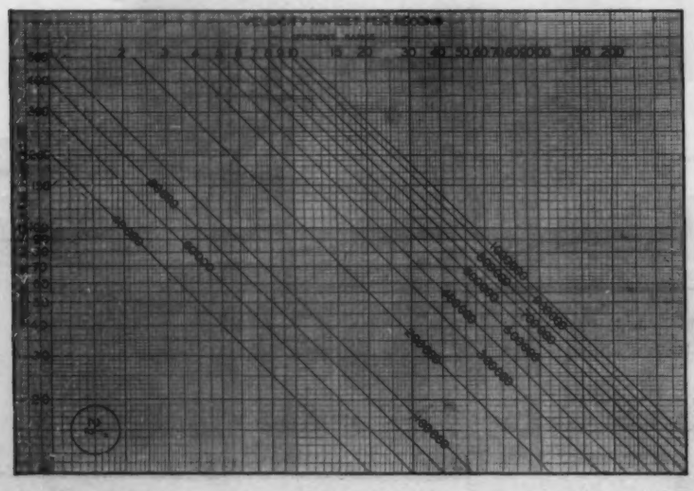


Fig. 10-G

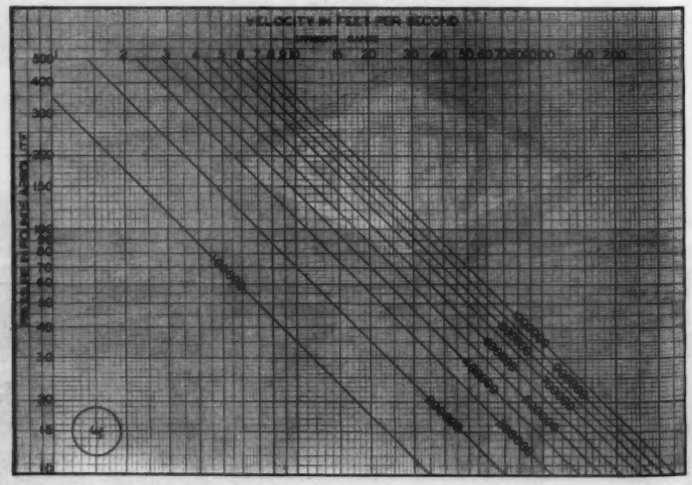
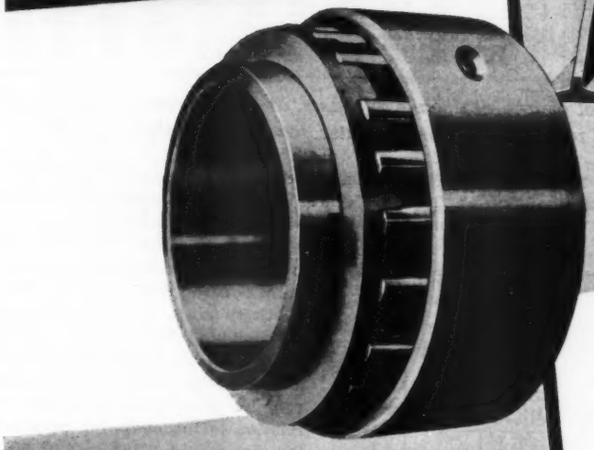
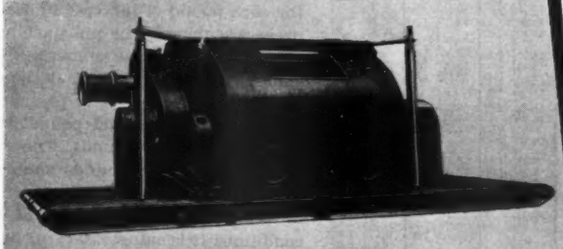


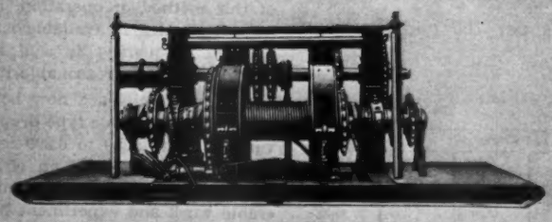
Fig. 10-H

When AMERICANS Get Together





DRAW WORKS (FRONT VIEW)



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nead piece of solid material which has drill holes of the same diameter, and the upper end of which is tapped to accommodate one-quarter inch pipes. These four pipes extend 5 or 6 feet upward, the lower parts of which are blank, thus affording an accumulation chamber or scrubber for the gas and the upper-most part being perforated for the entry of the gas. The lower end of the pipes within the chamber is open to the inside of the liner, permitting gas to surround the drop valve.

The annulus between the gas conduit and the flow string is sealed off with a stuffing-box equipped with check valve at a point above the packer. The stuffing-box is purposely placed a short distance above the packer, again forming a scrubber for the input gas. Such an arrangement limits the back-filling to the above mentioned annulus, the capacity of which is relatively small. The outside of this system is free from projections and presents no hazard in installation or removal. The drop unit equipped with a variation of the spring loaded Bryan S.D.X. is identical with the above-the-packer arrangement.

In the event that the static fluid level is initially very high, or the fill-up during shutdown period exceeds the available starting pressure, additional valves may be run above the drop valve for unloading purposes. It is also possible to unload through the casing by the removal of the valve unit, when the check valves are not added to the seating chamber. If a closed system is essential to meet the necessary operating conditions, then it is a certainty that the fluid should be completely evacuated from the annulus. This may be readily accomplished in the manner just described.

Foot Lift	POUNDS PRESSURE AT BOTTOM																
	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850
100	0.27	0.19	0.16	0.147	0.136	0.129	0.123	0.118	0.114	0.111	0.108	0.105	0.103	0.101	0.100	0.098	0.097
200	0.53	0.38	0.33	0.293	0.272	0.257	0.245	0.236	0.228	0.221	0.216	0.211	0.207	0.203	0.199	0.196	0.193
300	0.80	0.56	0.49	0.440	0.408	0.386	0.368	0.354	0.343	0.332	0.324	0.316	0.310	0.304	0.299	0.294	0.290
400	1.07	0.77	0.65	0.586	0.545	0.514	0.490	0.472	0.456	0.443	0.432	0.422	0.413	0.405	0.399	0.392	0.387
500	1.33	0.96	0.82	0.737	0.681	0.643	0.613	0.589	0.570	0.554	0.540	0.527	0.516	0.507	0.498	0.490	0.483
600	1.60	1.15	0.98	0.879	0.817	0.771	0.736	0.707	0.684	0.664	0.647	0.633	0.620	0.606	0.598	0.588	0.580
700	1.87	1.34	1.14	1.026	0.953	0.900	0.858	0.825	0.798	0.775	0.755	0.738	0.723	0.710	0.697	0.686	0.676
800	2.13	1.53	1.30	1.172	1.090	1.028	0.981	0.943	0.913	0.886	0.863	0.844	0.826	0.811	0.797	0.784	0.772
900	2.39	1.73	1.47	1.319	1.226	1.157	1.103	1.061	1.026	0.996	0.971	0.949	0.930	0.912	0.897	0.883	0.870
1,000	2.66	1.92	1.63	1.466	1.362	1.286	1.226	1.179	1.140	1.107	1.079	1.055	1.033	1.014	0.996	0.981	0.966
1,100	2.93	2.11	1.793	1.612	1.498	1.414	1.349	1.297	1.254	1.218	1.187	1.160	1.136	1.115	1.096	1.079	1.063
1,200	3.19	2.30	1.955	1.759	1.634	1.542	1.471	1.415	1.369	1.329	1.295	1.266	1.239	1.216	1.196	1.177	1.160
1,300	3.46	2.50	2.118	1.905	1.770	1.671	1.594	1.533	1.482	1.439	1.403	1.371	1.343	1.318	1.295	1.275	1.256
1,400	3.72	2.69	2.281	2.052	1.907	1.799	1.716	1.650	1.596	1.550	1.510	1.476	1.445	1.419	1.395	1.373	1.353
1,500	3.99	2.88	2.444	2.198	2.043	1.928	1.839	1.768	1.710	1.661	1.619	1.582	1.549	1.520	1.494	1.471	1.449
1,600	4.30	3.07	2.607	2.345	2.179	2.058	1.962	1.886	1.824	1.772	1.727	1.687	1.653	1.622	1.594	1.569	1.546
1,700	4.52	3.26	2.770	2.491	2.315	2.185	2.084	2.004	1.938	1.882	1.834	1.793	1.756	1.723	1.694	1.667	1.643
1,800	4.79	3.46	2.933	2.638	2.451	2.313	2.207	2.122	2.052	1.993	1.942	1.898	1.859	1.824	1.793	1.765	1.739
1,900	5.05	3.65	3.096	2.784	2.588	2.442	2.329	2.240	2.167	2.104	2.050	2.004	1.963	1.926	1.893	1.863	1.836
2,000	5.32	3.84	3.259	2.931	2.724	2.570	2.452	2.358	2.280	2.214	2.158	2.109	2.066	2.027	1.992	1.961	1.933
2,100	5.59	4.03	3.422	3.078	2.860	2.699	2.575	2.476	2.394	2.325	2.266	2.215	2.169	2.129	2.092	2.059	2.029
2,200	5.85	4.22	3.585	3.224	2.996	2.827	2.697	2.594	2.508	2.436	2.374	2.320	2.272	2.230	2.192	2.157	2.126
2,300	6.12	4.42	3.748	3.371	3.132	2.956	2.820	2.711	2.622	2.547	2.482	2.426	2.376	2.331	2.291	2.255	2.222
2,400	6.38	4.61	3.91	3.518	3.269	3.084	2.942	2.829	2.736	2.657	2.590	2.532	2.479	2.433	2.390	2.354	2.318
2,500	6.65	4.80	4.08	3.665	3.405	3.213	3.065	2.947	2.850	2.768	2.698	2.638	2.583	2.535	2.490	2.453	2.415
2,600	6.92	4.99	4.24	3.813	3.541	3.341	3.188	3.065	2.964	2.878	2.805	2.743	2.686	2.636	2.590	2.551	2.512
2,700	7.18	5.18	4.40	3.958	3.677	3.469	3.310	3.183	3.078	2.989	2.913	2.849	2.789	2.738	2.689	2.649	2.606
2,800	7.45	5.38	4.56	4.105	3.814	3.598	3.433	3.301	3.192	3.100	3.021	2.954	2.892	2.839	2.789	2.747	2.703
2,900	7.71	5.57	4.73	4.251	3.950	3.726	3.555	3.419	3.305	3.210	3.129	3.060	2.994	2.941	2.888	2.845	2.801
3,000	7.98	5.76	4.89	4.398	4.086	3.855	3.678	3.537	3.420	3.321	3.237	3.165	3.099	3.043	2.988	2.943	2.898
3,100	8.25	5.95	5.05	4.545	4.222	3.983	3.801	3.655	3.534	3.432	3.345	3.271	3.202	3.143	3.088	3.041	2.995
3,200	8.51	6.14	5.22	4.691	4.358	4.112	3.923	3.773	3.648	3.543	3.453	3.376	3.306	3.245	3.187	3.139	3.091
3,300	8.78	6.34	5.38	4.838	4.495	4.240	4.046	3.891	3.762	3.653	3.561	3.482	3.409	3.346	3.287	3.237	3.188
3,400	9.04	6.53	5.54	4.984	4.631	4.369	4.168	4.009	3.876	3.764	3.669	3.587	3.513	3.448	3.386	3.335	3.284
3,500	9.31	6.72	5.71	5.131	4.767	4.497	4.291	4.126	3.990	3.875	3.777	3.693	3.616	3.549	3.486	3.434	3.381
3,600	9.58	6.91	5.87	5.278	4.903	4.626	4.414	4.244	4.104	3.985	3.884	3.798	3.719	3.650	3.586	3.532	3.478
3,700	9.84	7.10	6.03	5.424	5.039	4.754	4.536	4.362	4.218	4.096	3.992	3.904	3.823	3.752	3.685	3.630	3.574
3,800	10.11	7.30	6.19	5.571	5.176	4.883	4.659	4.480	4.332	4.207	4.100	4.009	3.926	3.853	3.785	3.728	3.671
3,900	10.37	7.49	6.36	5.717	5.312	5.011	4.781	4.598	4.446	4.317	4.206	4.115	4.029	3.955	3.884	3.826	3.767
4,000	10.64	7.68	6.52	5.864	5.448	5.140	4.904	4.716	4.560	4.428	4.316	4.220	4.133	4.056	3.984	3.924	3.864
4,100	10.91	7.87	6.68	6.011	5.584	5.268	5.027	4.834	4.674	4.539	4.424	4.326	4.235	4.157	4.084	4.022	3.961
4,200	11.17	8.06	6.85	6.158	5.720	5.397	5.149	4.952	4.788	4.649	4.533	4.431	4.339	4.259	4.183	4.120	4.057
4,300	11.44	8.26	7.01	6.304	5.856	5.525	5.272	5.070	4.902	4.760	4.640	4.537	4.442	4.360	4.283	4.214	4.154
4,400	11.70	8.45	7.17	6.450	5.993	5.654	5.394	5.188	5.016	4.871	4.748	4.642	4.545	4.462	4.382	4.316	4.250
4,500	11.97	8.64	7.34	6.597	6.129	5.782	5.517	5.306	5.130	4.982	4.856	4.748	4.649	4.563	4.482	4.415	4.347
4,600	12.24	8.83	7.50	6.744	6.265	5.911	5.640	5.425	5.244	5.092	4.963	4.853	4.752	4.664	4.582	4.513	4.444

Table 2—Cubic feet of free air, sea-level basis, at given pressure theoretically required to raise one gallon of water to a given height in feet

INNER TUBING STRING							OUTER STRING													
			Diameters		Internal		Tubing—Nominal Size and Weight						Casing—O. D. Size and Weight							
Nominal Size	Weight per Foot Complete		Ex-ternal	In-ternal	Area Sq. In.	Vol. Bbls. per 100 Ft.	2½" 6.40 *6.50	2" 4.60 *4.70 10.20	3½" 9.30 *9.20 *11.00	4" 12.60 *12.75	4½" 16.00	5" 13.00 15.00 18.00 21.00	5½" 14.00 17.00 20.00	5¾" 14.00 17.00 19.50 22.50						
							Cross Sectional Area (Sq. Inches) and Volume (Bbls. per 100 Ft.) of Annular Space Between Inner and Outer String—Couplings Not Considered													
1¼"		*2.40	1.660	1.380	1.496	.185	2.32 .31 2.52 .31	4.87 .60 4.87 .60 4.54 .56	7.73 .96 7.33 .91	10.14 1.25 10.14 1.25	10.92 1.35	13.70 1.69 13.10 1.62 12.30 1.51 11.39 1.41	17.57 2.17 16.63 2.06 15.77 1.95	19.51 2.45 18.99 2.35 18.18 2.25 17.39 2.16						
1½"	2.75	*2.90	1.900	1.610	2.036	.252	1.84 .23 1.84 .23	4.20 .53 4.20 .52 3.87 .48	7.05 .87 6.68 .82	9.47 1.17 9.47 1.17	10.25 1.27	13.03 1.61 12.43 1.54 11.53 1.43 10.72 1.33	16.89 2.09 15.96 1.97 15.10 1.87	19.14 2.37 18.33 2.27 17.51 2.17 16.72 2.07						
2"	4.60	*4.70	2.375	1.995	3.126	.387		2.69 .32 2.69 .32 2.29 .28	5.46 .68 5.06 .63	7.87 .97 7.87 .97	8.66 1.07	11.43 1.41 10.83 1.34 9.93 1.23 9.12 1.13	15.30 1.89 14.37 1.78 13.50 1.67	17.55 2.17 16.73 2.07 15.92 1.97 15.13 1.87						
2½"	6.40	*6.50	2.875	2.441	4.680	.579			3.49 .42	5.81 .73 5.81 .72	6.00 .82	9.37 1.16 8.77 1.09 7.87 .97 7.08 .87	13.24 1.64 12.30 1.52 11.44 1.43	15.49 1.92 14.66 1.81 13.86 1.71 13.07 1.62						
3"	9.20	*9.30	3.500	2.992	7.031	.870						6.24 .77 5.64 .70	10.11 1.25 9.18 1.14 8.31 1.03	12.36 1.53 11.53 1.43 10.73 1.33 9.94 1.23						
3½"	10.20		3.980	2.922	6.706	.829						6.24 .77 5.64 .70	10.11 1.25 9.18 1.14 8.31 1.03	12.36 1.53 11.53 1.43 10.73 1.33 9.94 1.23						

Table 3—Annular area (in square inches) and volume (in barrels per 100 feet) between inner tubing string and outer string

INNER TUBING STRING							OUTER STRING													
			Diameters		Internal		Casing—O. D. Size and Weight													
Nominal Size	Weight per Foot Complete		Ex-ternal	In-ternal	Area Sq. In.	Vol. Bbls. per 100 Ft.	6⅝" 20.00 22.00 24.00 26.00 28.00	7" 17.00 20.00 22.00 24.00	7" 26.00 28.00 30.00 43.00	7⅝" 29.40 29.70 33.70	8⅝" 28.00 32.00 35.50 39.50	8⅝" 28.00 32.00 36.00 38.00 43.00	9" 34.00 38.00 40.00 45.00	9⅝" 36.00 38.50 40.00 42.00 43.50						
							Cross Sectional Area (Sq. Inches) and Volume (Bbls. per 100 Ft.) of Annular Space Between Inner and Outer String—Couplings Not Considered													
1¼"		*2.40	1.660	1.380	1.496	.185	26.57 3.29 26.01 3.22 25.37 3.14 24.76 3.06 24.18 2.99	31.41 3.89 30.57 3.78 29.99 3.71 29.37 3.63	28.77 3.56 28.16 3.48 27.56 3.41 23.68 2.93	35.98 4.45 34.96 4.32 33.78 4.18	41.54 5.18 40.67 5.03 39.52 4.89 38.36 4.75	45.32 5.95 47.11 5.83 45.93 5.68 45.31 5.61 43.81 5.42	51.81 6.41 50.60 6.26 50.00 6.19 48.50 6.00	60.34 7.46 59.34 7.40 59.14 7.32 58.64 7.25 58.04 7.18						
1½"	2.75	*2.90	1.900	1.610	2.036	.252	25.90 3.20 25.34 3.13 24.70 3.06 24.09 2.98 23.50 2.91	30.74 3.80 29.90 3.70 29.32 3.63 28.70 3.55	28.10 3.48 27.49 3.40 26.91 3.33 23.01 2.85	35.31 4.37 34.29 4.24 33.11 4.10	41.17 5.09 40.00 4.95 38.85 4.81 37.71 4.66	47.64 5.89 46.44 5.74 45.26 5.60 44.04 5.52 43.14 5.34	51.14 6.33 49.92 6.18 49.33 6.10 47.83 5.92	59.67 7.38 59.17 7.32 58.47 7.23 57.97 7.17 57.37 7.10						
2"	4.60	*4.70	2.375	1.995	3.126	.387	24.31 3.01 23.74 2.94 23.11 2.86 22.49 2.78 21.91 2.71	29.14 3.60 28.31 3.50 27.72 3.43 27.10 3.35	26.51 3.28 25.90 3.20 25.31 3.13 21.41 2.65	33.71 4.17 32.69 4.04 31.51 3.90	39.57 4.89 38.40 4.75 37.25 4.61 36.12 4.47	46.05 5.70 44.85 5.55 43.66 5.40 43.05 5.32 41.55 5.14	49.55 6.13 48.33 5.98 47.74 5.91 46.34 5.72	58.06 7.18 57.37 7.12 56.86 7.04 56.38 6.97 55.77 6.90						
2½"	6.40	*6.50	2.875	2.441	4.680	.579	22.25 2.75 21.68 2.68 21.04 2.60 20.43 2.53 19.85 2.46	27.08 3.35 26.24 3.25 25.66 3.17 25.04 3.10	24.44 3.02 23.84 2.95 23.25 2.88 19.35 2.39	31.65 3.92 30.63 3.79 29.45 3.64	43.99 5.44 42.79 5.29 41.60 5.15 40.98 5.07 39.48 4.88	47.48 5.87 46.27 5.72 45.66 5.65 44.18 5.46	56.01 6.93 55.51 6.87 54.82 6.78 54.29 6.72 53.71 6.64							

Table 3-A—Annular area (in square inches) and volume (in barrels per 100 feet) between inner tubing string and outer string

Producing prorated wells with drop valves is quite easily accomplished and constitutes a very satisfactory method. The valve in this type of installation is placed above the packer, at a point from which the allowable may be obtained. This point is determined from the fill-up curve, or productivity index. A rather wide range of conditions is possible at one point through the possibility of changes in the reopening pressure of the valve, as well as the variation of operating pressure. The opening pressure of the S.D.X. valve is in direct relation to the operating pressure, and therefore for each pound of increase in casing pressure, the necessary tripping or unbalancing pressure is increased by the same amount. For example: Assume that a valve has been designed to open at 100 pounds under the casing pressure. Then with a casing pressure of 300 pounds, the unbalancing load would be 200 pounds. Therefore, an increase in pressure to 500 pounds doubles the necessary load or requires 400 pounds.

With the modern methods of determining well conditions it is unnecessary to have failures with this valve. This is not meant to imply that it will operate under all conditions, but it does mean that it is possible to predetermine the feasibility of this method of operation. If an accurate productivity index is available it is possible to predict the frequency, as well as the volume per head within very reasonable limits.

Stripper wells are now being produced with the Bryan removable type drop-valve, from depths varying from 2,200 to 6,200 feet. The results are most satisfactory, and an efficiency as high as 30 per cent is not uncommon. Although considerable work and experiment has tended to establish a minimum operating or flowing submergence, it remains an established fact that wells are now producing with as low as 11 per cent submergence. The writer attributes this fact to the quick action of the valve, thus permitting the impact of the injected gas to at least partially overcome the obvious lack of submergence.

The fact that this device will operate satisfactorily under the above conditions means that it will be applicable to a very great majority of the prolific producers at this time. For example; this means that wells producing from 6,000 feet may be produced until the bottom-hole pressure has declined to a point below that necessary to sustain a column of 660 feet in height at its peak or maximum. Obviously this maximum occurs

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just prior to the operating of the valve, and for the remainder of the time the back-pressure changes with the fill-up of the well. It will be conceded that such wells are rarely produced continuously by any method, which means that back-pressure to some extent does exist in most instances.

The writer feels that the limit of spring-loaded valves without auxiliary equipment will be reached at the above mentioned point. This is due to the fact that below this point the back-pressure created, by virtue of frictional resistance to flow, will tend to prevent the valve from closing. Cognizance must be taken of the fact that any spring-loaded valve opens under a given load, and the source of that load is of no consequence. However, with the use of chambers and an automatic tripping or rocking arrangement it is quite possible that the producing limits of modern gas-lift may be extended to include virtually every producer except those entirely dependent upon capillary action or the force of gravity for a prime mover.

East Texas

The East Texas field contains approximately 25,000 wells, of which less than a third are equipped for artificial lift. During the rapid decline in pressure due to heavy withdrawals, a large number of wells were equipped unnecessarily. Since that time new wells have been added rather slowly. The homogeneous nature of the East Texas field, and the advantages of gravity, depth, and low allowables make this field ideal from a gas-lift standpoint. Approximately 2,500 wells are now equipped in East Texas and include every possible well condition, ranging from the two- to six-bbl. wells, on the extreme East side, to wells making large volumes of water on the West side.

Many of the wells in East Texas at this time require only agitation, and once started, easily flow their allowable. The majority of wells on gas-lift that require extraneous gas employ the use of mechanical flowing devices. At present the greatest source of power is the return of residue gas from the gasoline plants, but many small units have been installed during the past year. Gas-lifting in this field is a relatively simple operation and necessitates the very minimum of investment. Logically enough, the larger the number of wells to be produced from the same plant, the less the per well installation cost. Installation costs vary from $1,000 to a maximum of $2,000 per well.

Since it has already been explained that a given velocity is necessary to establish flow, it is obvious that a compressor must be of sufficient size to establish this velocity in two-inch tubing for even one individual well. The average rate through two-inch for gas-lift wells is approximately 20 bbls. per hour, and consequently 24 wells making no water may be produced from a compressor of the size necessary for one well. Therefore, no appreciable saving is effected by use of the method on leases having less than five wells, unless these wells should happen to be unusually large water wells. In such instances the possibilities of the gas-lift method are without question.

Operating pressures through the field vary from 250 to 400 pounds. An average for East side production, lifting no water, is approximately 275 pounds. Ratios vary on gas-lift wells from 300 to 500 cubic feet per barrel. Exceptions to this are the kickoff type that may only require 50 feet per barrel or the small wells that are permitted to accumulate their production, using the casing as a reservoir, and are flowed once daily. Such wells usually require 1,000 to 1,500 cubic feet per barrel. Intermitters have been rather widely experimented with, and the results have been satisfactory where constant pressure has been available. Indications are that intermitter installations will carry any East Texas well to

abandonment, and the input ratios vary from 300 to 750 cubic feet per barrel.

Complete re-cycling systems are very adaptable to East Texas operations. Likewise the increased revenue of gasoline extracted from wet gas return of West side gas-lift wells equipped with water knockouts is particularly evident. The extent of these returns, in some cases, has been reported to be in excess of the gross lifting cost.

East edge gas-lift wells are usually run with a packer, standing valve and perforation above the packer. (See Figure 9.) Gas-lift installations in East Texas are rapidly gaining momentum as the bottom-hole pressure declines.

Gulf Coast

Gas-lift operations in the Gulf Coast have for the most part been limited to those installations handling large volumes of water. However, such areas as Conroe are gradually feeling the need of gas-lift equipment. Many installations are necessary for starting purposes only, due to the bypassing of gas under prorated methods of producing. In such instances small tubing equipped with flow valves proves very effective. One of the main advantages of small tubing is the elimination of the necessity of stop-cocking methods.

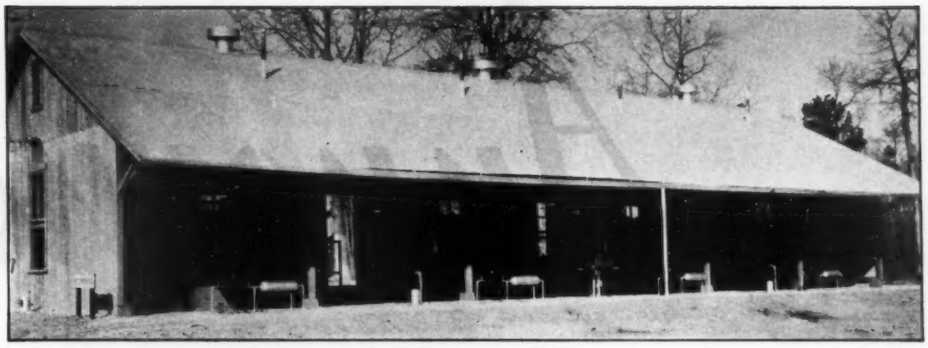
Due to sand conditions in the greater part of the Gulf Coast area, great care must be exercised in the rate at which a well is unloaded, therefore, stop-cocking is by no means the most desirable. It is the writer's opinion that surface chokes have proven very inefficient on gas-lift wells in every area. Small tubing and intermitting methods are particularly adaptable to Gulf Coast production. Either method will result in a control of the sand-face differential and eliminates many of the present sand hazards, as well as affording an economical method of producing.

The abundance of natural gas available in the Gulf Coast area makes the installation of gas-lift equipment very economical. However, there is possibly no other area in which a proper survey of well conditions is so essential. The aforementioned sand conditions warrant this precautionary measure. The completion of wells by the gas-lift method is a very satisfactory, and non-hazardous method for Gulf Coast wells.

Rodessa

The Rodessa field has approximately 80 wells equipped for gas-lift methods of producing. This represents nearly two-thirds of the wells on artificial lift at this time, or nearly 10 per cent of the oil wells in the entire Rodessa area. Rapid decline in bottom-hole pressures during the past 18 months, added to the effect of water encroachment has made some means of artificial lift nec-

(Continued on Page 140)



Union Production Co.'s single-stage compressor plant at Rodessa

Two-well geared unit with surface equipment converting rotary motion into reciprocating motion for pulling rods

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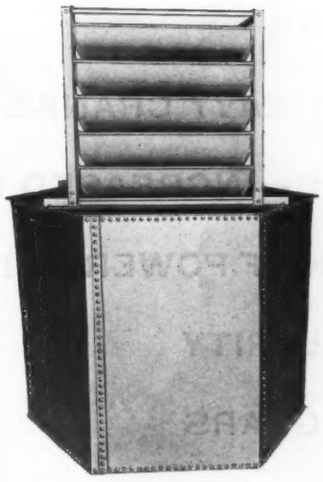

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- REDUCE ROD FAILURES—EVERY STROKE CUSHIONED WITH AIR
- GREATLY REDUCE INSTALLATION COSTS
- DECREASE PRODUCTION COSTS—LESS POWER CONSUMPTION
- REDUCE OPERATING COSTS
- REDUCE VIBRATION—NO HEAVY CRANKS TO BE ROTATED
- CUT PRODUCTION LOSSES—INCREASED PLUNGER TRAVEL
- HAVE SMOOTH OPERATION OF POWER UNIT REGARDLESS OF STROKE
- DECREASE PITMAN ANGULARITY
- INSURE LONGER LIFE OF GEARS
- ELIMINATE COSTLY FOUNDATIONS
- HAVE BETTER PUMPING UNIT SERVICE IN EVERY WAY

A FEW REPRESENTATIVE INSTALLATIONS OF

P. O. BOX
2119

REED ROLLER

the REED AIR BALANCED PUMPING UNIT

FLEXIBLE
ECONOMICAL
UNITIZED
PORTABLE

THE AIR BALANCED PUMPING UNIT IN VARIOUS FIELDS

BIT COMPANY HOUSTON TEXAS

essary. Differences in prorated allowables in the separate states have made corresponding differences in the rate of pressure decline. Producing oil from 6,000 feet has always been an expensive procedure, but in this instance, costs have been kept considerably below the average by the use of the gas-lift method.

One of the major operators of the field has gone almost exclusively to the gas-lift method. The extent of this particular gas-lift system is perhaps equal to any attempted in the Mid-Continent area for some time. Gas-lift installations include the following types of wells:

1. Wells having a low reservoir pressure.
2. Wells having insufficient gas.
3. Water wells.
4. Low productivity.

Every type of gas-lift installation is to be found in Rodessa, from the conventional open system to the drop valve or single valve installation of the closed system. Figure 4 illustrates the use of the long tail-pipe or fluid seal that is being used in this area.

Another type of installation that has proven very successful is the double string arrangement using a packer and velocity type valves, (see Figure 2). This type of installation is made necessary due to the existing pressure in the oil pay declining to a point below that of an unconnected gas horizon. Perforating has in such cases resulted in gas wells.

The gas is packed off with a hook-wall packer run on 2½-inch tubing, and seated immediately below the point of perforation in the casing. A string of 1¼-inch equipped with velocity type valves is then run on the inside of the 2½-inch. The well then requires but very little extraneous gas, and this may be furnished by regulating the bradenhead gas.

Per well installation costs for subsurface equipment in Rodessa rarely exceed $1,000 per well. The total approximate cost for a complete installation, including subsurface equipment, compressor, lines and all auxiliary equipment is $3,500. Due to low operating expense the pay out of such installations will be very rapid.

Operating pressures in the field vary from 260 pounds to 450 pounds for wells using flow valves. The discharge ratios on the Louisiana side must be under 2,000 feet to conform with state regulations. Input ratios vary from 600 to 1,800 cubic feet per barrel, depending upon well conditions. Wells producing as low as 35 bbls. per day have been efficiently produced.

INNER TUBING STRING						OUTER STRING											
						Casing—O. D. Size and Weight											
Nominal Size	Weight per Foot Complete	Diameters External	Diameters Internal	Area Sq. In.	Vol. Bbls. per 100 Ft.	5" 13.00 15.00 18.00 21.00	5½" 14.00 17.00 20.00	5¾" 14.00 17.00 19.50 22.50	6¼" 20.00 22.00 24.00 26.00 28.00	7" 17.00 20.00 22.00 24.00	7" 26.00 28.00 30.00 43.00	7⅝" 26.40 29.70 33.70	8⅛" 28.00 32.00 35.50 39.50	8⅝" 28.00 32.00 36.00 38.00 43.00	9" 34.00 38.00 40.00 45.00	9½" 36.00 38.00 40.00 42.00 43.50
						Cross Sectional Area (Sq. Inches) and Volume (Bbls. per 100 Ft.) of Annular Space Between Inner and Outer String—Couplings Not Considered											
3"	9.20	*9.30	3.500	2.992	7.031	.870	6.24 .77 5.64 .70	10.11 9.18 8.31	1.25 1.14 1.03	12.36 11.53 10.73 9.94	1.53 1.43 1.33 1.23	19.12 18.55 17.92 17.30 16.72	2.36 2.29 2.22 2.14 2.07	23.95 23.11 22.53 21.91	2.96 2.86 2.79 2.71	21.31 20.71 20.12 16.22	2.64 2.58 2.49 2.01	28.52 27.50 26.32 30.93	3.53 3.40 3.26 3.83	34.38 33.21 32.08 37.98 36.35	4.25 4.11 3.97 4.69 4.50	40.86 39.66 38.47 41.05	5.05 4.91 4.76 5.08	44.36 43.14 42.55 51.19 50.58	5.49 5.34 5.26 6.33 6.26	52.88 52.38 51.69 50.58	6.54 6.48 6.39 6.26
3"	10.20		3.500	2.922	6.706	.839	6.24 .77 5.64 .70	10.11 9.18 8.31	1.25 1.14 1.03	12.36 11.53 10.73 9.94	1.53 1.43 1.33 1.23	19.12 18.55 17.92 17.30 16.72	2.36 2.29 2.22 2.14 2.07	23.95 23.11 22.53 21.91	2.96 2.86 2.79 2.71	21.31 20.71 20.12 16.22	2.64 2.58 2.49 2.01	28.52 27.50 26.32 30.93	3.53 3.40 3.26 3.83	34.38 33.21 32.08 37.98 36.35	4.25 4.11 3.97 4.69 4.50	40.86 39.66 38.47 41.05	5.05 4.91 4.76 5.08	44.36 43.14 42.55 51.19 50.58	5.49 5.34 5.26 6.33 6.26	52.88 52.38 51.69 50.58	6.54 6.48 6.39 6.26
3½"	9.50		4.000	3.548	9.887	1.223		7.16 6.23	.89 .77	9.41 8.59 7.78 6.99	1.16 1.06 .96 .87	16.17 15.60 14.97 14.38 13.77	2.00 1.93 1.85 1.78 1.70	21.01 20.17 19.58 18.96	2.60 2.50 2.42 2.35	18.37 17.76 17.18 13.28	2.27 2.20 2.12 1.64	25.58 24.56 23.38	3.16 3.04 2.89	31.44 30.27 29.12 27.98 33.41	3.89 3.74 3.60 3.46 4.13	37.91 36.71 35.52 34.91	4.69 4.54 4.39 4.32	41.41 40.19 39.60 38.10	5.12 4.97 4.90 4.71	49.94 49.44 48.74 48.24 47.63	6.18 6.11 6.03 5.97 5.89
3½"		*11.00	4.000	3.476	9.690	1.174				9.41 8.59	1.16 1.06	16.17 15.60 14.97 14.38 13.77	2.00 1.93 1.85 1.78 1.70	21.01 20.17 19.58 18.96	2.60 2.50 2.42 2.35	18.37 17.76 17.18 13.28	2.27 2.20 2.12 1.64	25.58 24.56 23.38	3.16 3.04 2.89	31.44 30.27 29.12 27.98 33.41	3.89 3.74 3.60 3.46 4.13	37.91 36.71 35.52 34.91	4.69 4.54 4.39 4.32	41.41 40.19 39.60 38.10	5.12 4.97 4.90 4.71	49.94 49.44 48.74 48.24 47.63	6.18 6.11 6.03 5.97 5.89
4"	12.60	*12.75	4.500	3.958	12.304	1.522						12.83 12.27 11.63 11.02 10.44	1.59 1.52 1.44 1.36 1.29	17.67 16.83 16.25 15.63	2.19 2.08 2.01 1.93	15.03 14.42 13.84 9.94	1.86 1.78 1.71 1.23	22.24 21.22 20.04	2.75 2.62 2.48	28.10 26.93 25.78 24.64 30.07	3.48 3.33 3.19 3.05 3.72	34.58 33.37 32.19 31.57	4.28 4.13 3.98 3.91	38.07 36.85 36.26 34.78	4.71 4.56 4.49 4.30	46.60 46.10 45.41 44.90	5.76 5.70 5.62 5.55

Table 3-B—Annular area (in square inches) and volume (in barrels per 100 feet) between inner tubing string and outer string

INNER TUBING STRING				OUTER STRING															
				Tubing—Nominal Size and Weight				Casing—O. D. Size and Weight											
Nominal Size	Weight per Ft. Complete	Type	Coupling Diameter	1¼" 2.40 2.80	2" 4.60 4.70	2½" 6.40 6.50	2½" 8.60	4½" 16.00	5" 13.00 15.00 18.00 21.00	5½" 14.00 15.50 20.00	5¾" 14.00 17.00 19.50 22.50	6¼" 20.00 22.00 24.00 26.00 28.00	7" 17.00 20.00 22.00 24.00	7" 26.00 28.00 30.00 43.00	7⅝" 26.40 29.70 33.70	8⅛" 28.00 32.00 35.50 39.50	8⅝" 28.00 32.00 36.00 38.00 43.00	9" 34.00 38.00 40.00 45.00	9½" 36.00 38.00 40.00 42.00 43.50
				Cross Sectional Area of Annular Space in Square Inches Between Couplings and Outer String															
1¼"	2.40	Upset	2.200	.88 .88	3.23 3.23 2.90	6.09 5.69	8.50 8.50	9.29	12.06 11.46 10.56 9.75	15.93 14.99 14.13	18.18 17.36 16.55 15.76	24.93 24.37 23.73 23.12 22.54	29.77 28.93 28.35 27.73	27.13 26.53 25.94 22.04	34.34 33.32 32.14	40.20 39.03 37.88 36.74	46.68 45.48 44.29 43.68 42.18	50.17 48.96 48.37 46.87	58.70 58.20 57.50 57.01 56.40
1½"	2.75	Plain	2.169	.99 .99	3.34 3.34 3.01	6.19 5.79	8.61 8.61	9.39	12.17 11.57 10.67 9.96	16.03 15.10 14.24	18.28 17.46 16.65 15.86	25.04 24.48 23.84 23.33 22.64	29.88 29.04 28.46 27.84	27.24 26.63 26.05 22.15	34.45 33.43 32.25	40.31 39.14 37.99 36.85	46.78 45.58 44.40 43.78 42.25	50.28 49.06 48.47 46.97	58.81 58.31 57.61 57.11 56.50
1¼"	2.90	Upset	2.500		2.12 2.12 1.80	4.98 4.58	7.40 7.40	8.18	10.95 10.35 9.45 8.64	14.82 13.89 13.02	17.07 16.25 15.44 14.65	23.82 23.28 22.63 22.02 21.43	28.66 27.83 27.24 26.62	28.03 25.42 24.54 20.93	33.24 32.21 31.04	39.09 37.93 36.77 35.64	45.57 44.37 43.18 42.57 41.07	49.07 47.85 47.26 45.76	57.60 57.09 56.40 55.90 55.29
2"	4.60	Plain	2.870		.56 .56 .24	3.42 3.02	5.84 5.84	6.62	9.39 8.79 7.89 7.08	13.26 12.33 11.46	15.51 14.69 13.88 13.09	22.28 21.70 21.07 20.46 19.87	27.10 26.27 25.68 25.06	24.47 23.86 23.28 19.37	31.68 30.65 29.48	37.53 36.37 35.21 34.06	44.01 42.81 41.62 41.01 39.51	47.51 46.29 45.70 44.20	56.04 55.53 54.84 54.34 53.73
2"	4.70	Upset	3.060			2.53 2.14	4.95 4.95	5.73	8.51 7.91 7.01 6.20	12.38 11.44 10.58	14.63 13.80 12.99 12.20	21.38 20.82 20.18 19.57 18.98	26.22 25.38 24.80 24.18	23.58 22.97 22.39 18.49	30.79 29.77 28.59	36.65 35.48 34.33 33.19	43.13 41.92 40.74 40.12 38.62	46.62 45.40 44.81 43.31	55.15 54.65 53.95 53.45 52.85
2½"	6.40	Plain	3.517			.17	2.59 2.59	3.37	6.15 5.55 4.65 3.84	10.01 9.08 8.22	12.26 11.44 10.63 9.84	19.02 18.46 17.82 17.21 16.63	23.86 23.02 22.44 21.82	21.22 20.61 20.03 16.13	28.43 27.41 26.23	34.29 33.12 31.97 30.83	40.77 39.56 38.38 37.76 36.26	44.26 43.04 42.45 40.95	52.79 52.29 51.59 51.09 50.49
2½"	6.50	Upset	3.668				1.74 1.74	2.52	5.30 4.69 3.79 2.99	9.76 8.23 7.36	11.41 10.59 9.78 8.99	18.17 17.60 16.97 16.38 15.77	23.01 22.17 21.58 20.96	20.37 19.76 19.18 15.27	27.58 26.56 25.38	33.44 32.27 31.12 29.98	39.91 38.71 37.52 36.91 35.41	43.41 42.19 41.60 40.10	51.94 51.44 50.74 50.34 49.83

Table 4—Annular area between tubing couplings and outer string

INNER TUBING STRING				OUTER STRING															
				Casing—O. D. Size and Weight															
Nominal Size	Weight per Ft. Complete	Type	Coupling Diameter	4½" 16.00	5" 13.00 15.00 18.00 21.00	5½" 14.00 17.00 20.00	5¾" 14.00 17.00 19.50 22.50	6¼" 20.00 22.00 24.00 26.00 28.00	7" 17.00 20.00 22.00 24.00	7" 26.00 28.00 30.00 43.00	7⅝" 26.40 29.70 33.70	8⅛" 28.00 32.00 35.50 39.50	8⅝" 28.00 32.00 36.00 38.00 43.00	9" 34.00 38.00 40.00 45.00	9½" 36.00 38.00 40.00 42.00 43.50
				Area of Annular Space in Square Inches Between Couplings and Outer String															
2"	9.30	Plain	4.200		2.01 1.41	5.87 4.94 4.08	8.13 7.30 6.49 5.70	14.88 14.32 13.52 13.07 12.49	19.72 18.88 18.30 17.68	17.08 16.47 15.89 11.99	24.29 23.27 22.09	30.15 28.98 27.83 26.69	36.63 35.42 34.24 33.62 32.12	40.12 38.90 38.31 36.81	48.65 48.15 47.45 46.05 46.35					
2½"	9.30	Upset	4.504			2.80 2.86 2.00	6.05 5.22 4.42 3.62	12.80 12.34 11.60 10.99 10.41	17.64 16.80 16.22 15.60	15.00 14.39 13.81 9.91	23.21 21.19 20.01	28.07 26.90 25.75 24.61	34.55 33.35 32.16 31.55 30.04	38.04 36.83 36.24 34.74	46.57 46.07 45.37 44.87 44.27					
2½"	10.30	Plain	4.900		2.01 1.41	5.87 4.94 4.08	8.13 7.30 6.49 5.70	14.88 14.33 13.68 13.07 12.49	19.72 18.88 18.30 17.68	17.08 16.47 15.89 11.99	24.29 23.27 22.09	30.15 28.98 27.83 28.69	36.63 35.42 34.34 33.62 32.13	40.12 38.90 38.31 36.81	48.65 48.15 47.45 46.95 46.35					
3½"	9.50	Plain	4.750			2.01 1.08	4.26 3.44 2.63 1.84	11.01 10.45 9.61 9.30 8.62	15.85 15.01 14.43 13.81	13.21 12.61 12.02 8.12	20.42 19.40 18.52	26.28 25.11 23.96 22.83	32.76 31.56 30.37 29.76 28.26	36.26 35.04 34.45 32.95	44.75 44.26 43.59 43.09 42.48					
3½"	11.00	Upset	5.000				2.34 1.53	9.10 8.54 7.90 7.20 6.70	13.94 13.10 12.52 11.90	11.30 10.69 10.11 6.21	18.51 17.49 16.31	24.37 23.30 22.05 20.91	30.84 29.64 28.46 27.84 26.34	34.34 33.12 32.53 31.03	42.87 42.37 41.67 41.17 40.37					
4"	13.60	Plain	5.216					7.37 6.80 6.17 5.56 4.97	12.20 11.37 10.78 10.16	9.57 8.99 8.38 4.47	16.78 15.75 14.58	23.63 21.47 20.31 19.15	29.11 27.91 26.72 26.11 24.61	32.61 31.39 30.80 29.50	41.14 40.63 39.94 39.44 38.83					
4"	12.75	Upset	5.563					4.43 3.87 3.23 2.62 2.03	9.27 8.43 7.84 7.22	6.62 6.02 5.44 1.44	12.84 12.82 11.53	19.70 18.53 17.38 16.24	26.17 24.97 23.79 23.17 21.67	29.67 28.45 27.86 26.36	38.20 37.70 37.00 36.50 35.90					

Table 4-A—Annular area between tubing couplings and outer string

The amount of gas-lifting that has been done in the Southwest Texas area is probably greater than any other area in Texas. Similar to the Gulf Coast, this has no doubt been due to an ample supply of cheap power, or high-pressure gas. Wells have been completed with flow valves in this area for several years, and gas-lift in general has been very popular. Sand conditions again necessitate careful consideration of producing rates.

Virtually every field in Southwest Texas has employed gas-lift to some extent, and operating pressures and ratios vary with the depths and volumes produced. The continuance of the use of gas-lift in this area is the best indication of its success.

The writer has been fortunate enough to have had considerable experience in West Texas and New Mexico. Data from approximately 250 installations indicate that the method is quite applicable to existing producing problems. A large portion of the wells in West Texas flow on their own gas, and the extraneous gas necessary is furnished by gas wells. A paper presented by the writer before the Permian Basin Chapter of A.P.I. at Midland on April 23, 1937, covers the West Texas and New Mexico areas in greater detail.

MANUFACTURER, INC

NORRIS *Surface Equipment*

NO. 915 ADJUSTABLE COUNTER-BALANCED STROKE POST

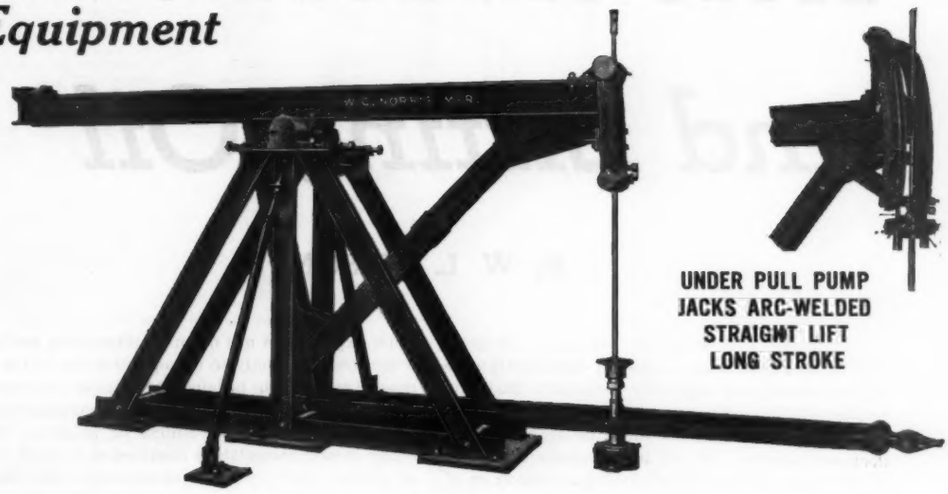
HEAVY DUTY STROKE POST

HEAVY DUTY PENDULUM HOLD-DOWN

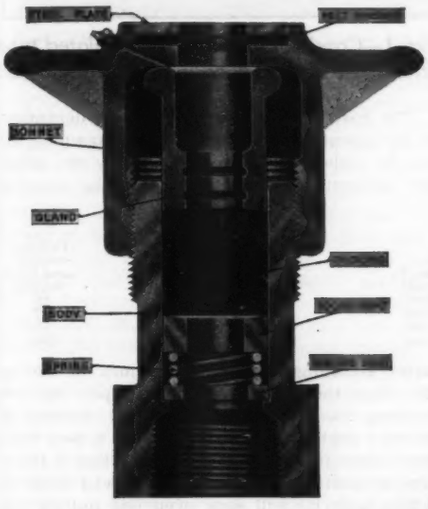
ROD LINE MULTIPLIER

LINK TYPE SWING

NOTCHED BAR KNOCK-OFF

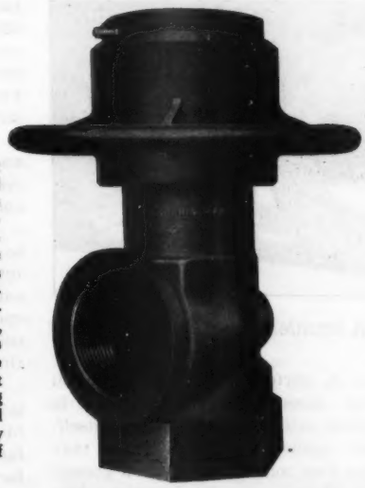


UNDER PULL PUMP JACKS ARC-WELDED STRAIGHT LIFT LONG STROKE



The new NORRIS Free Wheeling Stuffing Box meets the demand for a low priced, efficient and economical unit of advanced design. Note that the hand wheel allows packing take-up from any position. The oil reservoir in the gland permits lubrication of the polished rod with pressure grease. The leather washer prevents loss of grease and keeps out weather and grit. Furnished in two types, Regular and "Tee Type", both are equipped with babbitt or bronze loose seats, malleable iron bonnets, and semi-steel bodies. "Tee Type" box eliminates use of a Tee fitting under the box to connect on to the lead line and also allows stuffing box to be set lower. "Pull-through" type allowing rod pulling jobs by merely unscrewing the bonnet. All internal parts pull out with the polished rod. Lubrication by our pressure grease system prolongs the life of both the polished rod and the packing.

NORRIS FREE WHEELING STUFFING BOX



NORRIS Pump Jack

ARC-WELDED Structural steel frame self-contained, with welded beam.

CAPACITIES: No. 509-6,500 lbs. No. 610-8,000 lbs. No. 812-12,000 lbs. No. 915-16,000 lbs. No. 1218-20,000 lbs.

PRESSURE GREASE BEARINGS.

BRONZE BUSHED BEARINGS with oil grooves to carry lubricant full length of bearings from large oil reservoirs.

OIL RETAINERS to hold oil and keep rain and dust out.

LONG STROKE adjustable by moving the pull-bar bearing up or down on the plates.

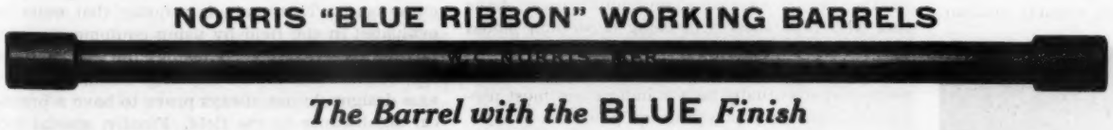
STRAIGHT LIFT is accomplished through an arrangement of link design. Wire Line Horsehead is optional at no additional charge.

ADJUSTMENT of the Jack in relation to the well is positively controlled by moving saddle bearings by adjusting screws and by vertical adjustment of diagonal braces by means of their threaded ends.

NORRIS "Blue Ribbon" WORKING BARREL

NORRIS "Blue Ribbon" Seamless Steel Working Barrels "the Barrel With the Blue Finish", has the highest inside finish of any Barrel on the market, being reamed and honed, insuring extremely long valve cup life and the tolerances to which they are held is well within A.P.I. Standards. Made from highest quality seamless cold drawn steel tubes, manufactured to extreme standards of precision, with careful inspections guarding each step in manufacture, they are free from all defects. Also furnished in BRONZE of the same precision manufacture and to A.P.I. Standards for corrosive conditions.

NORRIS "BLUE RIBBON" WORKING BARRELS



The Barrel with the **BLUE** *Finish*

Manufacturer, Inc.

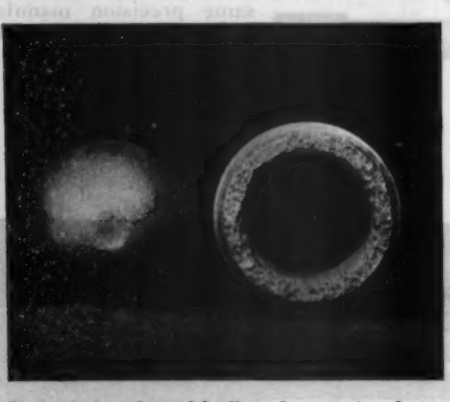
Role of Metals in Pumping and Lifting Oil

By W. L. NELSON

The severe corrosive and abrasive actions that must be met in deep-well pumping equipment are obviously conditions that cannot be alleviated by mechanical means alone and hence superior materials must be employed. In deep-well service, the oil is so remote from the surface that methods of inhibiting corrosion or of separating the abrasive agents by effective mechanical means are not now tenable. Hence, there has been a continual development and use of new materials which are suited to corrosion or abrasion. As an example, one of the largest rod manufacturers states that nearly all of the rods that their company ships to the Oklahoma City field are nickel-moly rods (S.A.E. 4615) and that fully 75 per cent of the rods shipped in recent months to Kansas have been alloy steel rods. In the latter case the stronger rods are necessary because of the particularly severe allowable test that is now employed in the State of Kansas. Although the majority of working barrels are estimated to still be plain carbon steel, it is interesting to note in the case of liners that one of the large pump manufacturers does not even list a plain carbon steel liner for sale. This company lists alloy steel liners and several kinds of alloy and plain cast iron liners but no plain steel liners.

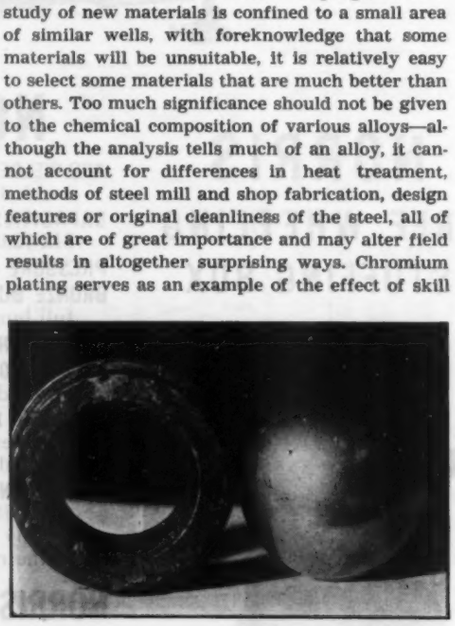
Selection of Metals

The attitude of the true industrial metallurgist regarding the application of special alloys or metals to any specific service is always an economic one. He carefully audits the situation on a dollars and cents basis to see just how much total money it takes to operate when using the regular materials and when using the new material. It seems that this should be the logical approach to the selection of pumping materials and yet in many cases operators have become confused, and later disappointed, because they have listened to reports of phenomenal behavior in far-distant fields or in fields with which they were only vaguely familiar.



Corroded tool-steel ball and seat after being in service for 15 days

Such experiences are often disillusioning and are a detriment not only to the operator but to the industry as a whole because they cause conflicting reports of the behavior of worthy materials and lend indirection to the course of progress. If a study of new materials is confined to a small area of similar wells, with foreknowledge that some materials will be unsuitable, it is relatively easy to select some materials that are much better than others. Too much significance should not be given to the chemical composition of various alloys—although the analysis tells much of an alloy, it cannot account for differences in heat treatment, methods of steel mill and shop fabrication, design features or original cleanliness of the steel, all of which are of great importance and may alter field results in altogether surprising ways. Chromium plating serves as an example of the effect of skill



Corrosion on stainless-steel ball and seat

in manufacture. A perfectly formed chromium plate (or better, chromium bonded directly to steel) may perform well and quickly pay for itself, whereas a poorly applied plate of chromium may be scarcely better than common steel and a grossly poor investment. This situation has actually arisen in the industry because some manufacturers have met with high success in using chromium plated pumps whereas others have been unsuccessful and are even a hindrance to further developments of what may eventually be a standard and most useful modification of pumping equipment.

For the particular problem of selecting materials for pumping equipment there are several economic factors which should be considered in making a cost study.

a. Degree of corrosion and abrasion. In practice this means that the study must usually be confined to a single small area or consistent field. Laboratory studies usually cannot be relied upon except in a most general way to point to general types of materials.

b. Cost of repair or pulling in event of failure. This is also a factor that must be determined for the actual field by experience with previous jobs, however, the following tabulation gives some idea of the average cost of rod and tubing jobs.

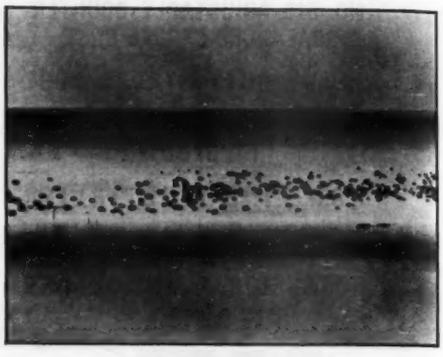


Fig. 1—Condition of a chromium-plated tube after 30 days of service in a nonsulfide well

The cost of repairing the pump is dependent on the extent of the damage but as examples, the cost of replacing cups, counting only the labor, may amount to $7, or to replace the working

RELATIVE COSTS

Depth, feet	Pulling rods, dollars	Pulling tubing (and rods) dollars
2,000	9	15
3,300	12	27
4,400	23	58
5,800	35	100

barrel, counting only the labor, may be $20 or $30. Thus, the cost of each pump repair job, not counting the cost of materials may amount to $35 for a shallow well, or to $125 for a deep well. From these figures it is easily seen that a fairly large amount can be spent for a special material if that material will save even one pulling job and that if you are fortunate enough to find really suitable materials, the saving may be of such magnitude that it will double the net profit.

c. Cost of new material. Such costs are easy to obtain but they should be based on finished total pump costs rather than raw steel costs because the fabrication and obtainment of these special alloys in particular forms, such as small tubing or in small quantities, often increases the final cost disproportionally.

d. Other factors. A factor usually considered is the loss in production during down-time, but in the face of proration it would seem that this factor is no longer of great importance. Another factor is the mechanical design of the equipment (and this is not always reflected in a higher purchase cost). This again is a factor that must be evaluated in the field by using equipment manufactured by different companies but of the same materials. Theoretical reasonings behind the various designs do not always prove to have a practical significance in the field. Finally, special factors may arise such as the unusually fast pumping rate used in the Kansas allowable test.

Types of Alloys

The purpose of the following discussion is to suggest the general types of alloys that are suitable rather than to discuss particular details of equipment or mechanisms of of chemical corrosion. The chromium steels have long been considered as the standard material for resisting sulfide corrosion but in the cast of oil-well equipment they do not seem to be suitable unless a very high percentage of chromium is employed. The chromium alloys fail to withstand sulfide corrosion if abrasion is also active because the

TABLE 1—SUCKER-ROD MATERIALS

Name—	S.A.E.	Load	Corrosive condition	Endurance limit, lb. per sq. in.	Corrosion fatigue (sulfide) lb. per sq. in.	Per cent C	Per cent Mn	Per cent Si	Per cent Mo	Per cent Ni	Per cent Cr	Heat treatment
Plain carbon steel (cheap)	1050	Light	noncorr.	35,000	.....	0.50	0.70	0.22	....	....	....	None
Plain carbon steel (heat treated)	1050	Medium	noncorr.	52,000	11,000	0 50	0.70	0 22	....	....	....	(*)
Carbon manganese steel (low)	....	Medium	noncorr.	53,000	16,000	0 37	1.3	0 24	....	....	....	(*)
Chrome moly steel	4130	Very heavy	noncorr.	74,000	.....	0 30	0.65	0.20	0 20	....	0 65	(†)
Carbon manganese steel (high)	T 1335	Heavy	noncorr.	56,000	12,000	0 35	1.75	0.22	....	....	....	(*)
Wrought iron	....	Light	corrosion	30,000	16,500	0 05	0.04	0.16	....	....	....	
Nickel moly iron	....	Medium	corrosion	45,000	22,000	0 08	0.35	....	0 25	4 0	....	(*)
Nickel moly steel	4620	Heavy	severe corr.	52,000	22,500	0 20	0.70	0.24	0 25	1 8	....	(†)
Nickel moly steel	4815	Heavy	severe corr.	.....	.....	0.15	0.70	0.25	0.25	3 5	....	..

*Entire rod normalized. †Entire rod normalized, quenched and drawn.

abrasive action continually exposes a new surface of metal for corrosive action or does not permit the formation of the protective film of oxide or rust which normally prevents further corrosive attack. However, if corrosion by sulfide (or combination of sulfide and brine) is very severe, the 18 per cent chromium 8 per cent nickel steel is universally accepted as the only material that will withstand the action with any success. This material is expensive and its use is therefore confined to the most severe conditions that arise, examples of which are West Texas and parts of California, and even for these conditions the use of 18-8 chrome nickel is not always most economical. Some success has been attained in lining working barrels or plungers with stainless steel.

In general the metals such as nickel, molybdenum, vanadium and silicon, which add greatly to the tensile strength of steel, have been found to be useful, but all of these except the nickel must be used sparingly because they are hardeners as well as strengtheners, and thus tend to cause mild brittleness. Nickel actually adds ductility to a steel and hence nickel is used widely in conjunction with the above metals to gain great strength and at the same time retain sufficient flexibility to avoid brittleness. Among the many low percentage alloy steels that are proving valuable, the nickel-molybdenum combination appears to be particularly useful for petroleum services. These alloys have a high strength and hardness, fair corrosive resistance, and are particularly resistant to fatigue corrosion such as that encountered by sucker-rods. Most of the above steels are not known to exhibit great corrosion resistance to sulfide or brine (in other industries than petroleum) and hence their superior behavior in the petroleum industry may be due in part to their superior physical properties such as toughness, and to their greater strength. Obviously, a strong material may be permitted to corrode to a thinner final section before removing it and thus stay in operation longer before failure even though the material is destroyed by corrosion at nearly the same rate as regular steel. However, these steels are actually more resistant to corrosion than plain steel.

For salt water corrosion there are no really good materials. The commonly used alloys are the copper-base alloys such as the brasses and bronzes, and monel metal. Note however, that the copper-base alloys are not able to withstand sulfide corrosion. Furthermore, the copper-base alloys are too weak for most pump or rod parts and have only one notable application—for balls and seats used under magnetic conditions that would render steel inoperable. K-Monel metal balls and seats are used in shallow wells for combined brine and sulfide corrosion and are reported to withstand corrosion more successfully than any materials except stainless steel.

Chromium plate is extremely resistant to corrosion and abrasion and has been used with outstanding success in many pump installations. The history of the development of chromium plating has been one of countless difficulties and anomalies. Most of these have not been successfully over-come although there are still many cases of failure as indicated in Fig. 1, and there are severe conditions for which the chromium plated equipment is found to be entirely unsuited.

TABLE 2—MATERIALS FOR COUPLINGS FOR RODS

Name—	S.A.E. classification	Relative corrosion resistance	Load	Per cent C	Per cent Mn	Per cent Ni	Per cent Cr	Per cent Mo
Carbon steel	1030	Poor	Light	0.3	0 75	....	....	
Wrought iron*	....	Fair	Medium	0.04	0.04	....	(slag 3.2%)	
Chrome nickel steel	3115	Poor	Heavy	0.15	0.45	1 25	0 6	....
Nickel steel	2315	Fair	Medium	0.15	0.45	3 5	....	....
Nickel moly steel	4615	Good	Heavy	0 15	0 55	1 8	....	0 25

*For use with wrought iron rods.

TABLE 3—POLISH-ROD MATERIALS

Name—	S.A.E.	Corrosive conditions	Load	Per cent C	Per cent Mn	Per cent Ni	Other elements
Plain steel	1020	Noncorr.	Light	0 20	0 45	....	.....
Carbon manganese steel	T 1335	Noncorr.	Heavy	0 35	1.7	....	.....
Chrome molybdenum steel	4130	Mild corr.	Heavy	0.30	0 6	....	0.25 Mo; 0.6 Cr.
Nickel molybdenum steel	4620	Sulfide corr.	Heavy	0 20	0 5	1 8	0.25 Mo.
Stainless steel	30915	Brine corr.	Heavy	0.12	0 5	8 0	18.0 Cr; 0.75 Si max.
Monel metal	....	Severe corr.	Heavy	(23-32 Cu; 60-63 Ni; 3.5 Fe; small Si or others)			
Bronze or brass	....	Brine corr.	Light	(60 Cu; 30 Zn; 1 Tin)			
Silicon Bronze	....	Brine corr.	Medium	(96.25 Cu; 3.25 Si; 0.5 Sn)			

TABLE 4—PUMP LINER MATERIALS

Name—	Heat treatment	Per cent C	Per cent Mo.	Per cent Ni.	Per cent Cr.	Per cent others
Cast iron	Partially chilled	3 0	....	....	....	1.1 Si
Chrome nickel moly iron	Yes	3 2	0.35	0 6	0 2	2.1 Si
Molybdenum cast iron	Yes	3 2	0 42	....	....	2.1 Si
Nitricast iron	...	2 75	0 24	....	1 22	(1.01 Al; 0.16 Va.)
Nickel moly steel (carburized)	Yes	0 15	0 25	1 7	....	.....

TABLE 5—MATERIALS FOR BALLS AND SEAT

Name—	Service	Depth	Per cent C	Per cent Ni	Per cent Cr	Per cent Si
Tool steel	Noncorr.	Any	0 5	....	....	....
Bronze or brass	Brine	Shallow	(60 Cu; 39 Zn; 1 Sn)			
K-monel	Severe corr.	Shallow	(63 Ni; 30 Cu; 3.5 Al; 1.5 Fe)			
Stainless steel	Severe corr.	Deep	0.11	8 0	18.0	0 75 Max.
Stainless steel (Si)	Severe corr.	Deep	0 4	7.5	19.0	1.2

Crolay equipment, which is essentially a layer of chromium applied directly to steel, appears to be meeting with unusual success. Regular chromium plating is applied very thinly and a bonding agent, such as copper, must be plated to the steel first to attain good adhesion of the chromium. The Crolay equipment in one Oklahoma field is said to be working with less than 2 per cent of failures that may be attributed to the condition of the chromium surface. When Crolay equipment does prove to be successful, the length of service ranges from 2 to 40 times the length of service obtained with regular equipment. However, chromium plating is not always successful as indicated in Fig. 1, which shows the condition of a plunger after operating 30 days in a nonsulfide well in the Gulf Coast area. Failure results either by abrasion or a pin-point penetration which spreads rapidly into the underlying steel by electrolytic action. A major difficulty in chromium plating has been the avoidance of minute holes, thin spots or soft spots in the plate during manufacture and of course these faults result in rapid failure. Design likewise plays an important part—as an example, sharp edges such as those created by grooves, receive the brunt force of abrasive particles and will fail by crushing through the plate, then by rapid corrosion and abrasion beneath the plate.

Embrittlement of stainless-steel ball and seat

Sand and Abrasion

The metallurgists' answer to abnormal wear by abrasion is to use a hard material. The most common hard material is cast iron, and pump lines for shallow wells are often constructed of this material. Again, low percentage alloy steels of much the same composition as those discussed above, are also found to be hard or are particularly suited to hardening by heat treating operations. Metallic chromium is exceedingly hard but it must be backed by a relatively hard metal and the layer of copper that is so often necessary for attaining a tight coating may result in soft spots in the chromium plate. Chromium plate has an indirect ability to deter abrasive action because closer fits can be attained when plungers and tubes are chromium plated. Slippage is decreased and thus less fine sand is rubbed between the metal surfaces.

Cast iron is again attracting attention not only for pumps but in all fields of industry. Developments during the past 10 years have produced irons with tensile strengths ranging from 50,000 to 80,000 pounds per square inch which is in the range of regular steel and even a little stronger. These strong irons permit the use of cast iron

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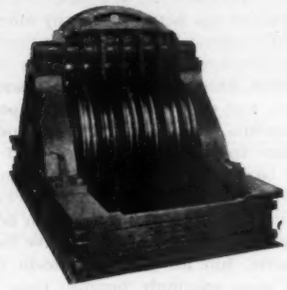

TYPE "KY" CROWN BLOCK—five or six-42" OD slow-wearing manganese-molybdenum steel sheaves, 300 and 360-ton capacity respectively with high safety factor; special designed Hyatt roller bearings; 7.873" diameter forged alloy steel center pin; patented A-frame construction reduces overall height and distributes load evenly to all corners of derrick.

TYPE "PY" TRAVELING BLOCK—300-ton capacity with high safety factor; sheaves and center pin same as in Crown Block; bail and becket pins of large diameter high-tensile nickel steel; extra heavy steel plates; forged alloy steel bail, split to distribute load evenly throughout block; streamline construction with low center of gravity makes for speed with safety.

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liners in deep wells as well as the customary service in shallow wells. In fact, it may be possible to develop the use of cast iron for other pump parts for shallow wells. Most of these strong irons are also more resistant to corrosion than regular iron or steel and are usually slightly better than alloy steels in this respect. The relative cheapness of cast iron is also a powerful argument for its use. One company is seriously considering the use of cast iron as extensively as possible in its line of pumps, based on a study of the cost of replacements and the superior resistance of this material as against the higher cost of steel parts.

Inconel, an alloy containing 78-80 per cent nickel, 12-14 per cent chromium and 6-8 per cent iron, has proven to be highly successful in resisting oil-well corrosion. Pumps having outer tubes of this material have operated five or six times as long as regular tubes. However, most operators are dismayed by the high cost even though all experience to date shows that the use of Inconel actually saves money. It may also be difficult to get the fine grade of tubing material that is required for oil-well equipment, when used in such small amounts.

An extremely hard material referred to as Di-Hard has recently been offered to the industry. This material consists essentially of a cast-iron type of alloy containing as the special ingredient, a combination of nickel and boron which imparts extreme hardness and abrasion resistance. It has been used for some time as a liner material for slush pumps but its use for deep-well pump plungers and tubes is only now being investigated. Preliminary reports indicate excellent service and resistance to corrosion.

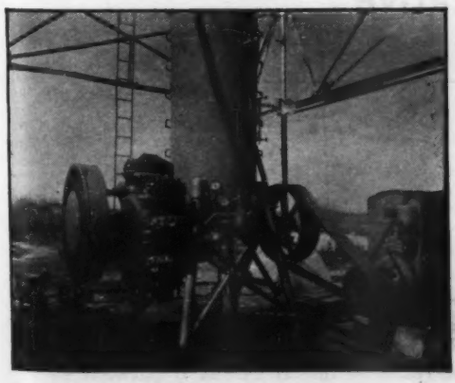
The following discussion of specific materials that have and are being used for pump and rod services must be handled to some extent by means of tables. A discussion of each alloy would be only a repetition of much that has been stated above under the heading of Types and Alloys and hence the reader is asked to turn back to this section for the properties of many of the materials listed hereafter.

Sucker-Rods. Activity in the development of sucker-rod materials has probably exceeded all other studies. The resistance of sucker-rods to corrosion has been definitely shown to be proportional to the corrosion fatigue limit. This property is determined by repeatedly stressing the material in the presence of the corrosive agent (in this case sulfide brine) at loads below the fatigue limit the material can be stressed for an unlimited number of times without failure. Most of the common sucker-rod materials are included among those shown in Table 1, or are similar to the materials there shown.

Couplings and Polish-Rods. The couplings used to connect the rods must be exceedingly hard and tough to withstand the abrasion and stresses involved in pulling or lowering the pump-string. and to maintain stiffness. Thus, the main body of the coupling must be of tough strong steel and the outside is usually hardened to withstand abrasion. This is usually accomplished by carburizing and case hardening although hardening may also be accomplished by Ihrigizing (increasing the silicon content of the surface) or by nitriding the surface. The silicon hardened material is said to be very resistant to corrosion. Coupling materials are shown in Table 2.

Polish-rods are subject to rubbing or abrasion as well as corrosion and hence special materials are employed. Some of these are shown in Table 3. It is common to cover regular steel rod with some resistant material such as monel metal or stainless steel.

Pump Parts. In pumps, the special alloys have not been adopted to a large extent except for particularly severe conditions or for those special parts such as balls and seats, and liners, which receive the brunt of the corrosive and abrasive action. Working barrels, tubes or plungers have been constructed of nickel and the nickel steels, of the low percentage chrome nickel steels for greater strength (not good for sulfide corrosion) and of stainless steel or nickel molybdenum steel (S.A.E. 4615) for severe corrosion conditions. The use of chromium plating or covering has been discussed previously. Some common liner and valve materials are shown in Tables 4 and 5. The property of most interest in liner materials is the hardness and hence many of the irons shown in Table 4 are in the "white-iron" or pearlitic condition which means that much of the carbon is in the combined form rather than as soft graphite. The alloy irons are usually oil quenched at about 1,525° F. and drawn or tempered. Centrifugal casting of the iron, which results in a denser more uniform and stronger iron, is being practiced by some companies.



Hydraulic pumping unit. Note radial-type pump design

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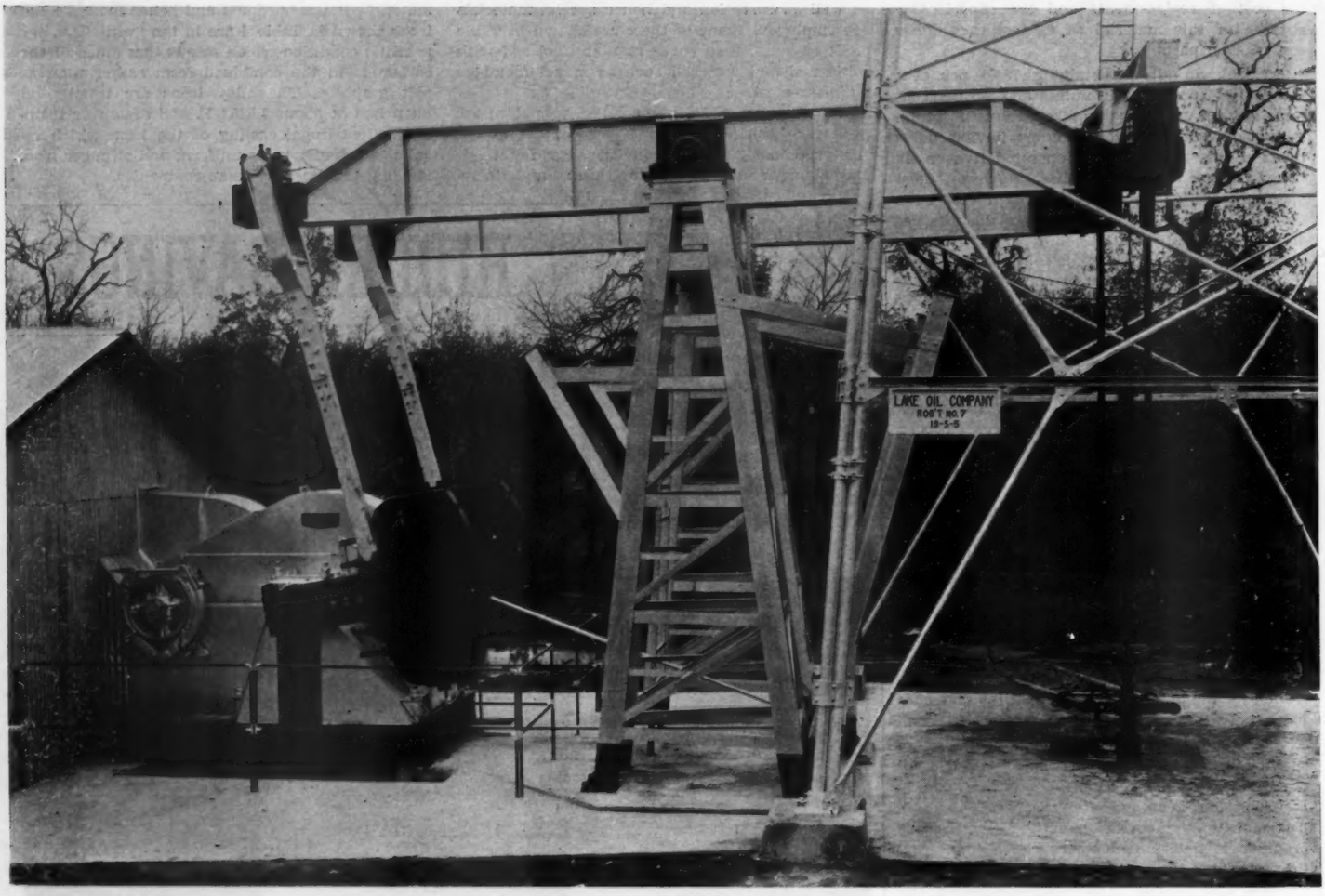

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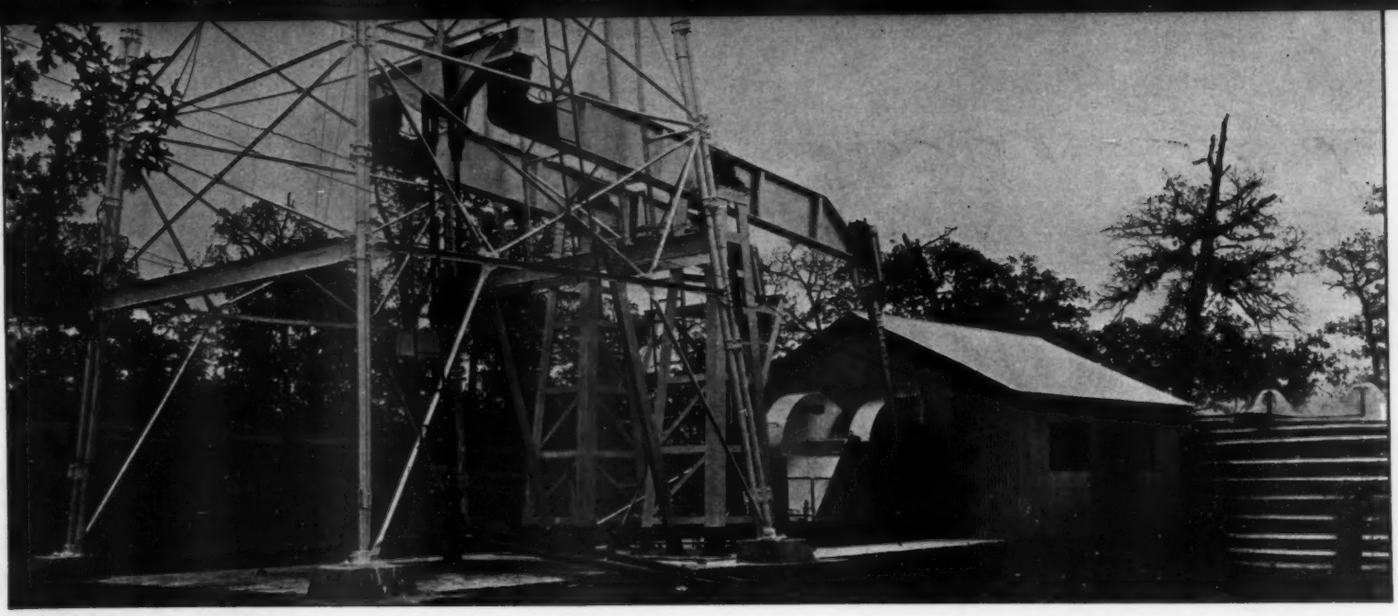


High-volume pump on a well near Ada, Okla. It is powered by a 100-hp. twin-cylinder gas engine through a reduction gear. The beam carries a load of of 50,000 pounds. Approximately 3,500 bbls. of fluid are raised daily

Sucker-Rod Pumping Service Improved by Well Studies

The operation of wells pumped with sucker-rods has been improved to such an extent, as the result of well studies, that the present trend is toward an attitude which does not accept the usual amount of sucker-rod trouble as an inevitable and necessary evil. A recent survey of work done in the diagnosing of trouble shows that while these studies entail considerable expense, results obtained over a period of time show that this kind of trouble shooting is worth it. The procedure followed in analyzing conditions which lead to trouble has taken the direction in the last year or two of seeking a practical operating solution rather than theoretical formulas or their application.

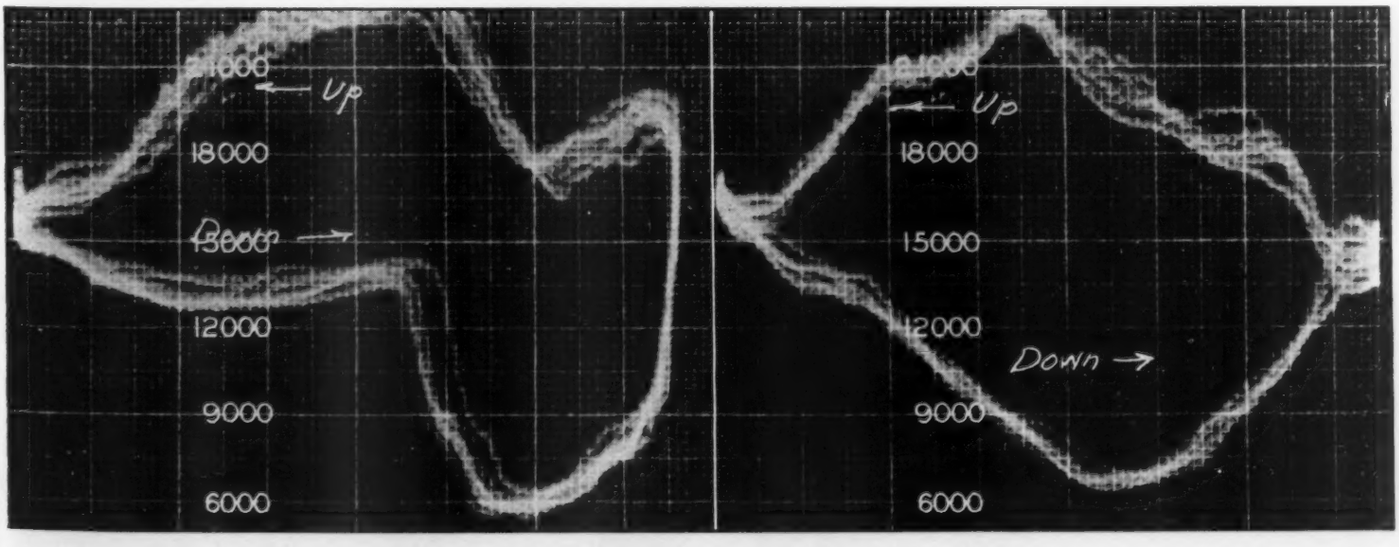
A $10,000 saving in lifting costs is the progress report of one engineer covering his first six months' activities in well-study work. Other men too, who have been engaged in this activity during the last year or two, report unusual progress which is of extreme importance to all producing operators.

The very nature of sucker-rods and their service has caused many operators to feel that if they have to use sucker-rods some breaks are to be expected. Although this may be partially true of some types of wells, it is not true for all wells.

There is little question that study and efficient operation can, in many cases, show some remarkable cost savings in the operation of pumping wells through a close study of their individual characteristics and the sucker-rods being used. In these days of small profits the opportunity of lowering lifting costs through better sucker-rod service is one which cannot very well be overlooked, and a number of operators have recognized the importance of this subject through the establishment of an activity to overcome some of their difficulties, with most pleasing results.

Sucker-rod service is, after all, a product of two principal functions: First, the operating facts of the well and, second, material selection. In order to understand why sucker-rods offer the possibilities we have intimated, we will consider these two functions first and from them perhaps glean a better understanding of the opportunities involved.

(Continued on Page 154)



Card showing a severe pound in a Seminole, Okla., well, which is pumped-off. Sucker-rods started to fail one month after installation and eight rod-breaks were experienced in the second month

This card shows the elimination of the pound by merely slowing the well down. New rods were installed and motion retarded; the result being that there were no failures in three months

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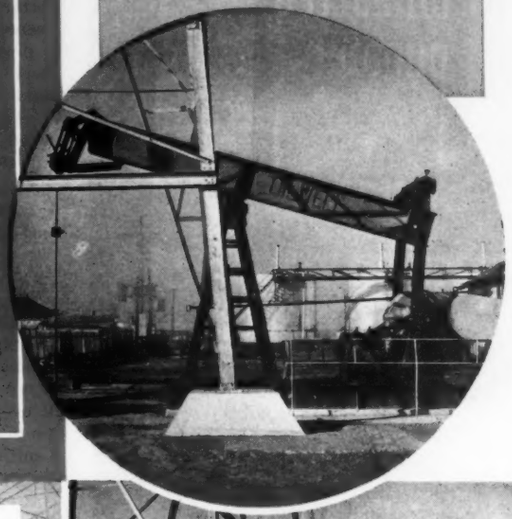
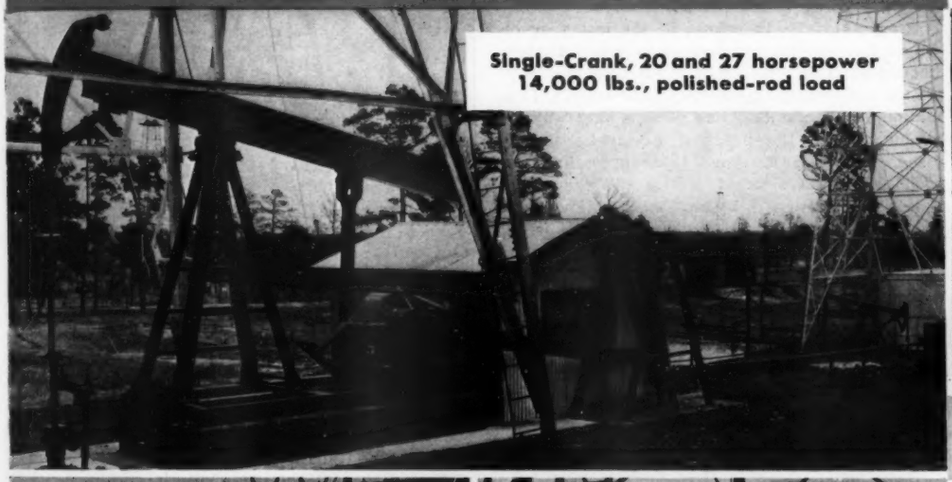


Twin-Crank, 27 and 35 horsepower
25,000 lbs., polished-rod load

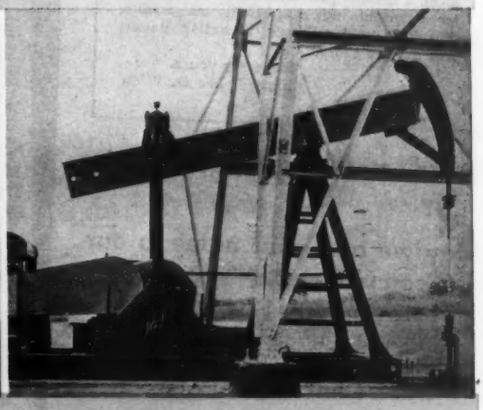


Single-Crank, 20 and 27 horsepower
14,000 lbs., polished-rod load

Twin-Crank, 27 horsepower
20,000 lbs., polished-rod load

Single-Crank, 27 and 35 horsepower
20,000 lbs., polished-rod load

Single-Crank, 10 horsepower
10,000 lbs., polished-rod load



Twin-Crank, 20 horsepower
14,000 lbs., polished-rod load

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The Wheatley Pumper
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Mr. Dan O'Shea, Editor:
Dear Sir:

About an hour ago, I came in from our two wildcats; one of which we are skidding the rig from and leaving 1,750 feet of nice big expensive hole, the other has just picked up a stray water and am going to have to underream the 12½-inch casing, blue, busted, and disgusted, so to speak.

Sixty minutes later, and I have read Vol. No. 6 of The Wheatley Pumper from its pleasant green cover to cover, and by the way the first copy I have seen around our office. Thanks a lot for it anyway, and do not fail to send me the future editions, and in return for them and the good laughs I have just had when I needed them most, I assure you that when need arises for a portable pump to handle our production from said wildcats Wheatley Pumps will get the order.

Sincerely yours,
(signed) Lee O. White

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A study of operating facts seems necessarily to come first because material selection in so many cases must depend upon the conditions to be met. Conversations with a number of engineers who have devoted nearly all of their time to such studies during the past year shows that this is an extremely complex field, offering opportunity for considerable initiative and inventiveness on the part of the man conducting such a program. In discussing work accomplished, there was an inclination at first to look for a formula or standard treatment which would suffice in most cases, but none of the engineers contacted report the existence of such an equation. Experience seems to be the primary factor.

This experience has not come cheaply, and probably the reason that more attention has not been given to this subject is the fact that its development is the product of patience and ingenuity. As one engineer put it, "each well is nearly a separate problem and as individual as a human being. Of course we learn things from our experience with one well which help us to eliminate certain things with another well and I do not intend to tell you that you have to start all over again on each well. However, much to our initial disgust we found that each well was a sufficient problem in itself to justify careful thought and nearly independent analysis."

Progress made, therefore, in the last year or two on this subject has been more practical than theoretical. It is true that a great deal has been written concerning the theory of the activity in a pumping well and this has gone a long way in helping toward the practical results accomplished. The records show that successful programs which have saved dollars and cents and caused management to become increasingly interested have been those where a practical operating result has been the goal in preference to additional theory.

Many well troubles are the simple product of overload but without a well study this is often difficult to establish. There are innumerable records of wells in which the operator was sure the loads were not heavy, but when weighed and studied showed that sucker-rods were being badly overloaded. The first and most simple type of overload is commonly known as a polished-rod overload, and is easily measurable with a surface indicator at the polished-rod. This type of overload means, simply, that the weight of the rods plus the weight of the fluid being handled is too much for the sucker-rods at the particular speed and stroke at which the well is being operated. There are a number of ways to correct this and a man experienced in well-study work, in even complicated instances, can often devise means of lowering these loads within the practical endurance of the sucker-rods without making any large reduction in production obtained, and in a few fortunate cases, insuring an increase in fluid recovered.

The second type of overload is a good deal more indefinite and difficult to locate than the first. For lack of a better name it may be called a vibratory overload, due to an accumulation or concentration of stress at some particular point in the string of rods. As this condition may occur at nearly any place in a well it is most difficult to approach and chart. Some efforts have been made in this direction through use of a subsurface dynamometer and hopes are expressed that additional knowledge of a technical nature on this subject can be developed. To date, experience is the best approach and a number of engineers have been quite successful in overcoming such troubles through study of the well, its operating characteristic and history.

Substantial foundations built to meet the requirements of a heavy load

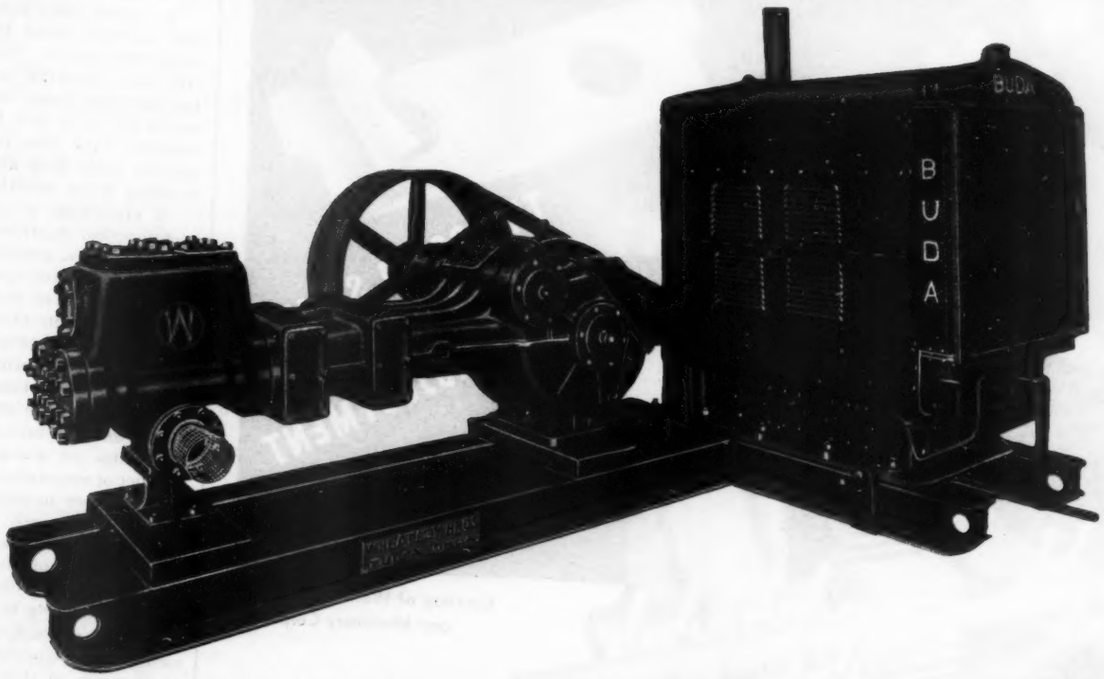
Pound, an old pumping-well disease, seems to be becoming more contagious as records show it developing with disconcerting rapidity in many of our newer wells and may be the product of a number of things. The use of too large plungers, the presence of gas, too rapid motion and a variety of other operating factors may lie at the root of this evil. To destroy an old oil-country bogey, it can be safely stated that most pounds are not necessary and can be done away with through a study of the well and its individual characteristics.

One engineer who has done much well-study

Two views of a triple well location in the Fitts pool, Oklahoma, where production is pumped from three formations: the Cromwell sand, Hunton lime, and Wilcox sand

FIRST

IN THE HEARTS OF OIL PRODUCERS



For continuous heavy duty service over a long period of time you can't beat Wheatley Pumps. Although ruggedly built to insure dependability their operating cost is surprisingly low. The pump illustrated, Figure 2150, is only one of the many types of Wheatley Duplex Power Pumps for all services of oil fields. Standard Price List with illustrated data will be sent on request.

WHEATLEY BROS., PUMP & VALVE MFGRS., TULSA, OKLAHOMA.

work finds that pumping wells generally fall into three classifications. The first of these covers the well which has too many rod breaks. This type is, of course, easily recognizable but many times has been allowed to continue its improper operation beyond necessity. One common excuse for letting such a well go is that it is a "key well" on the lease and no one can afford the responsibility of shutting it down or slowing it up for study purposes. This, in most cases, is a fallacy because the comparatively small time it takes to study such a property and get it in proper running order is nothing compared with the accumulated down-time resulting from the breaks and replacements caused by its faulty operation. This engineer's experience with many wells of this kind indicates that a great many of them can quite simply be corrected through an analysis of the pumping facts involved, plus a simple recognition of economics.

The second classification of troublesome wells, as made by this engineer, covers those whose volumetric efficiency or production results are too low. This type of property is many times most difficult to recognize and may be called a "pumping sneak thief." Superficially such a well may be appearing to perform as best it can, while actually it is stealing both unnecessary power and production because of inefficient operation which may not be easy to determine.

New pumping wells mark the third classification spoken of and here diversified experience becomes a most valuable tool. The question of selecting material for new pumping properties is becoming an increasingly large one, particularly as wells are going deeper and this phase of the problem is not confined to sucker-rods alone. The simple expedient of exchanging information, considering typical fluid characteristics or the particular geology involved, and tempering these with the experience obtained from studying a variety of pumping wells will go a long way toward avoiding unnecessary and costly errors in starting a new pumping property on an economical career.

The operating facts of pumping wells form the conditions which sucker-rods must meet and control the service which they will give. The purchase of a dynamometer, the calculation of a well's characteristic, fluid and metallurgical analyses are only a part of well studies. A great deal of progress has been made in studying the operation of pumping wells and in such a program, just as in any other engineering work, skill, knowledge and experience are necessary.

Considerable progress nas also been made in the past few years on the problem of material selection in sucker-rods. Better materials are available today and their uses and qualities better understood than at any period in the past. Practically all manufacturers are now publishing metallurgical and chemical specifications of the materials offered and more and more attention is being given by production engineers to fitting the proper rods to operating conditions.

In recent years it has become well recognized that strength alone is not the answer to good sucker-rod service. Yield point is important, and still more important is that the steel in question has balanced properties if tough service requirements are to be met. Ductility and impact values therefore take their place with strength, and engineers today keep all three of these yard sticks in mind when selecting sucker-rods.

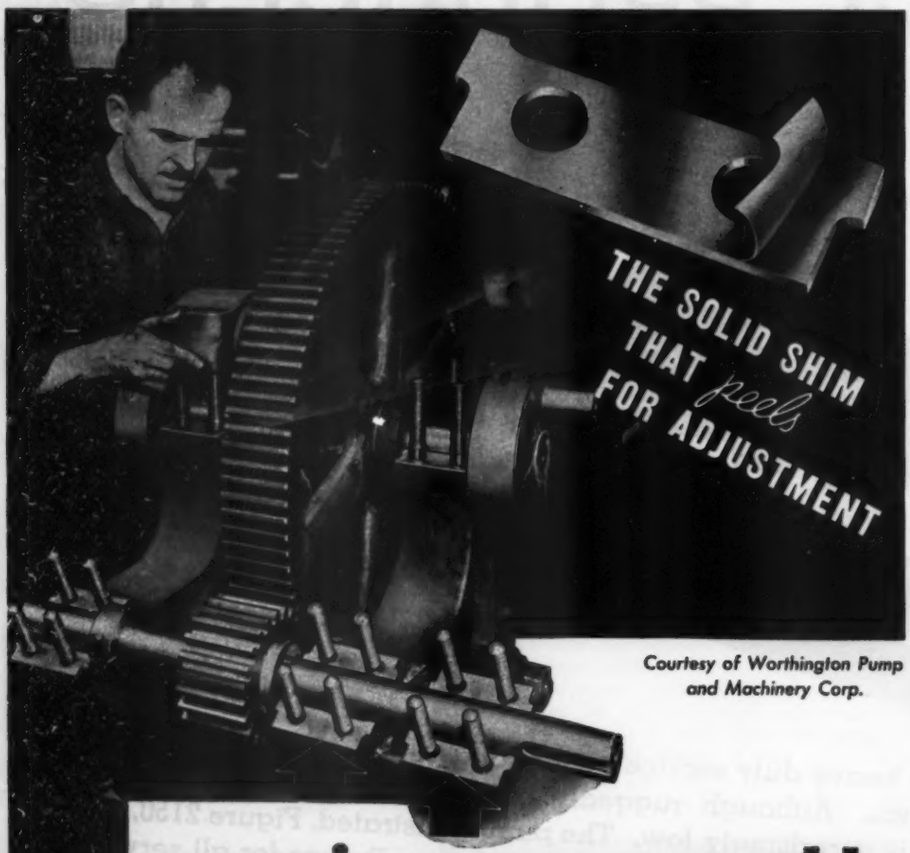
A knowledge of pumping conditions and of metallurgical qualities of sucker-rods will also, in many cases, allow the selection of less expensive materials for simpler operation, so that the old complaint of wanting one type of rod is avoided through better knowledge of operating facts and materials quality.

Much of the progress made during the last few years in sucker-rod pumping has been the result of intimate cooperation between the producer and sucker-rod manufacturer. A better knowledge of pumping conditions and of the product of requirements to be met, has enabled the manufacturer to develop new and improved materials, which are today saving the industry thousands of dollars in lifting costs each month. A continuance of this cooperation will undoubtedly pay additional dividends. The producer on the other hand, by a better knowledge of the manufacturers' product, and its qualities, can more easily appreciate the limitation within which he must work so that disappointment and unsatisfactory material performance are reduced.

The question of understanding between the producer and manufacturer has also been benefited in the past year through the production of talking moving pictures. These have not only brought some of the problems of the manufacturers in visual form to the field, but have also illustrated some of the things which should be avoided if good sucker-rod service is to be had.

Care and handling, an old subject too, has been given a good deal of attention and it seems that this perennial will be one that must be dealt with constantly, but which can be made to pay good dividends through proper educational work. Changes in personnel, new pumping fields and product development all work to keep care and handling a constantly new and active subject, which is essential if lifting costs are to be kept to improved figures.

As one engineer puts it, sucker-rod pumping has never been fully exploited. New instruments, new procedures and better material all offer the opportunity for lowering lifting costs through the study and coordination which these factors make possible. Ten thousand dollars in six months is an index of what may lie ahead, and the progress started during the past few years undoubtedly will lead to a considerable further improvement in this method of recovering oil.



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Oil-Well Casing Pumps Finding Widespread Applications

Following several years of research and experimentation, the first oil-well casing pumps were introduced on the market in January, 1934. Since that time important developments and improvements have been made continuously in the design and construction of their integral parts, until today casing pumps for oil well use are well established for a wide range of conditions.

At the present time over 500 casing pumps are in service in such representative hard pumping fields as: Kermit, Hendricks, Luling, Panhandle, Talco, East Texas, Big Springs, McCamey and many Gulf Coast fields of Texas; the Smackover and El Dorado fields of Arkansas; the Seminole, Fitts, Drumright and other fields of Oklahoma; the Jal field in New Mexico; the Houma, Leeville and other Louisiana Gulf Coast fields; at Mount Pleasant, Michigan, and in many of the hard pumping fields of western Kansas.

In the beginning, the casing pump was thought to have a rather limited application in wells of high fluid level and large volumes. After continuous research and improvements in pump parts and settings, and much actual field experimentation under all conditions, the application of casing pumps has been extended now to almost all types of wells, even under the most severe pumping conditions. They have been used successfully in wells from 1,500 to 4,500 feet in depth, producing as much as 5,000 bbls. of dead fluid per day, or up to as high as 12,000 bbls. per day when reservoir pressure aided in maintaining high fluid levels.

PUMPING TESTS OF 12 CASING PUMP INSTALLATIONS ON ELECTRICAL POWER—WINKLER COUNTY, TEXAS

Well	Size pump (inch)	Ft. pump lift	No. S.P.M.	Length stroke	Bbls. oil per day produced	Bbls./day fluid	KW load at test	HP load at test	Cost/bbl. lifted
1	4	2,000	20	54	93	1,620	8.9	12 0	$0 0459
2	4	2,000	19	48	154	2,290	10.1	13 5	0 0315
3	4	2,000	22	48	46	2,355	11.2	15 0	0 117
4	5	2,000	21	48	30	4,230	4.66	6 25	0 074
5	5	2,000	22	52	62	3,042	11.4	15 3	0 088
6	4	2,000	24	74	50	4,277	11.4	15 3	0 109
7	5	2,000	21	54	70	3,490	11.0	14.8	0 075
8	4	2,000	20	42	63	1,263	7 76	10 4	0 059
9	4	1,950	24	62	36	2,780	9 4	12.6	0 125
10	4	2,200	21	56	20	3,300	9 6	12 86	0 23
11	5	2,050	21	48	80	4,800	14 25	19 1	0 085
12	5	1,650	21	56	36	2,000	9 36	12 53	0 125

The principle of pumping oil-well fluids through casing is not patented, but the special features which make it practical are fully protected by a large number of patents.

Principles of Design

Briefly, the casing pumps of the two principal designs (differing only in the smaller details of construction) consist of a specially designed packer, which seals off against the casing by means of an expanding head, below which is the conventional working barrel with standing and traveling valve. Any make of working barrel of the desired size may be used within the casing pump body if desired, but unless otherwise specified, the complete pumping assembly is supplied. Cups, balls and seats, and other pump parts are interchangeable. The assembly may be anchored at the desired depth by one of several means, such as: (1) By tubing catcher; (2) it may be set on top of a liner; (3) by extending mud or gas anchor to bottom; or (4) any other setting or anchoring device suitable to the particular installation. At first, the application of casing pumps was somewhat restricted to wells where casing had been run to or below the desired pump position. This limitation has since been removed by the advanced method of setting packer and extending tubing with working barrel on bottom down into the open hole as far as conditions require.

The expanding packer is made of a synthetic product known as "Neoprene" which is chemically inactive with oil, and will not adhere to casing or expanding head. A drain arrangement permits the release of fluid when necessary to remove the pump from the well. After the pump is anchored, the submerged polish-rod operates through stuffing-box at the pumphead just above the Neoprene packer. The pumphead is so constructed that it slides up and down through about a 5-inch range when being run, but is sufficiently heavy so that when in operation it will set down in the drain-sleeve and keep the portholes closed and prevent unloading or leakage of fluid.

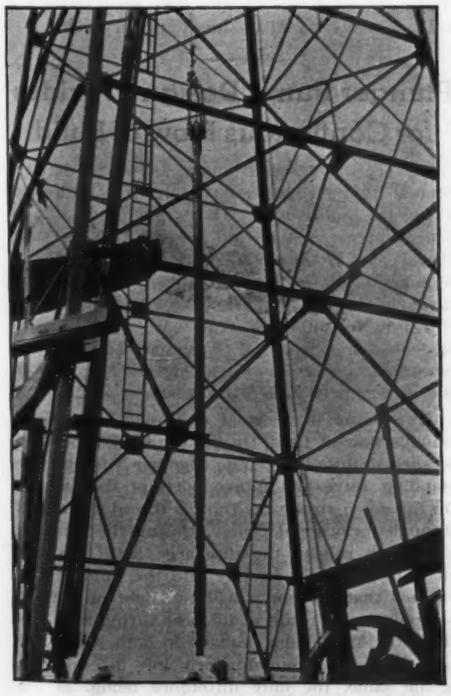
The pump assembly itself remains stationary, the only motion being that of the traveling valve above the standing valve near the base of the assembly. The outer pump body is usually specified to be the largest size that will enter the well casing. A special swedge nipple at the bottom permits attachment on tubing-catcher or other type anchor. Such an arrangement minimizes vibration of the pump against the casing while in operation.

Special features are provided in the pump construction to simplify the running, setting, or pulling of casing pumps. Lighter pulling equipment is required for wells using casing pumps, and only a rod job is needed when making repairs to the pump or changing its size.

Wellhead connections on wells producing by casing pumps are of the simplest type, usually requiring only a casing-tee with swedges to stuffing-box and flow-line.

The demands upon surface pumping equipment or sucker-rods have been found to be no more severe than in other types of pumping. Wells which previously have been pumping from backside cranks or on central powers are not required to install any heavier lifting equipment when a change-over is made to the casing pump. Dynamometer card readings under a wide variety of pumping conditions and cycles all show a close similarity or a reduction in actual polish-rod loads.

Two important factors in the lifting of oil-well fluids, or solutions work to the advantage of casing pumps in keeping down actual loads at the polish-rod. In fact, these two factors are largely responsible for the practicability of casing pumps. First, the ratio of frictional area to total fluid being lifted in, say, the inside of 5$\frac{1}{16}$-inch casing, is much less that the ratio of frictional area where the same fluid is passing between the same size rods inside of 2$\frac{1}{2}$-inch tubing. Furthermore, in fluid columns where this ratio of frictional area is reduced and



View of casing pump assembly ready for installation in the hole. Just below the elevator is seen the casing-wall packer; then the casing pump body itself, and then the tubing catcher for use as anchor

Showing salt water production being pumped from a Hendricks pool in West Texas, using casing pump at 21 strokes per minute, 72-inch strokes. Daily production 5,300 bbls.

larger diameter columns are permitted, the natural energy from the well itself (either gas or hydrostatic) is permitted to act more effectively and result in a higher fluid level, with accompanying reductions in lifting load. It is not the actual volume lifted that determines polish-rod loads, but the height from which it is being lifted. Therefore, the fullest exertion of natural reservoir energy in maintaining a high fluid level is taken advantage of in the casing pump by employing the largest diameter fluid column possible.

As a result of these two natural factors, polish-rod loads and required pumping horsepowers are somewhat lower than those recorded on tubing-equipped pumping wells, all other conditions being equal. In this fact lies one of the casing pump's greatest operating advantages, in that where, for instance, a 2½-inch working barrel will not handle all the fluid required, a change to a 3-inch working barrel in casing pump can be made with no additional demands upon the sucker-rods or surface equipment.

As a general rule, pumping cycles may be reduced when using casing pumps without sacrifice of volumes lifted. The change from a certain size smaller pump to a larger working barrel on casing pump may be made, and the same volumes handled at a considerably slower and more economical cycle.

Size of Working Barrels

In wells of high fluid level, volumetric efficiencies are usually very high in the conventional type of tubing sucker-rod pumping wells. This is, of course, true of the casing pumps also. The high efficiency can be maintained and extended with the casing pump up to a certain point where the maximum fluid being yielded from the formation is being handled. It sometimes has been the mistaken idea that the larger the working barrel the more fluid could be lifted with casing pumps. However, where the available fluid volume is not sufficient to prevent pounding, undue reversals and sucker-rod strain will result in the breaking of rods and other allied damages.

Possible damage to the casing by rod wear was at one time thought to be a serious limitation on the extended application of casing pumps. Long experience has shown that this is not true except in wells that deviate greatly from vertical. In such wells, rod-guides have been used successfully. Both the casing and rods are afforded some protection

Stream of salt water separated from oil coming from a well being pumped by casing pump at 20 r.p.m. with 54-inch stroke

against corrosion, because, by keeping them in a submerged state, oxygen and free hydrogen sulfide are excluded.

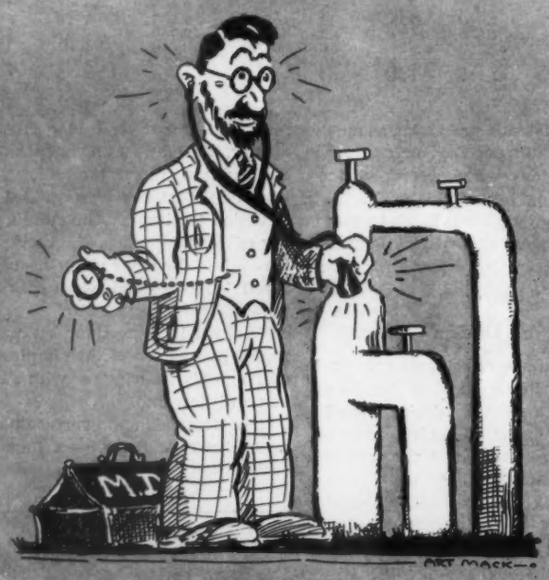
The fishing of broken sucker-rods in casing is simplified by the use of a special large guide which screws onto a regular rod socket. The outside diameter of the guide is specified to be near enough to the inside diameter of the casing to prevent the rods passing between them. If the broken rod is standing away from the casing wall it will follow through the guide and into the socket. If the rod is leaning against the casing wall, a rotation of the fishing rods will push it away from the wall and cause it to follow into the guide and rod socket.

The accompanying table is a full pumping record of 12 typical wells employing the casing pump in the Hendricks field of Winkler County, western Texas. As in all wells in this pool, fluid levels and ratios of water to oil produced are very high.

Plunger Pump Design Provides for Continuous Flow of Fluid

A specially designed pump, known as the Hydraulic Pump manufactured by the Hydraulic Pump Co., Smackover, Ark., is pumping wells in deeper areas of the Gulf Coast, such as New Iberia and Houma, La., and High Island and Spindletop, Tex., in addition to a distribution throughout Texas, Louisiana, and Arkansas fields. Gratifying results are reported in pumping at Rodessa, La., where oil is pumped at high temperatures, sometimes even as high as 200° F. after the oil has been raised to the stock tank.

The pump is designed to provide for a continuous flow of fluid. On the top stroke the fluid is sucked into the pump chamber through the standing valve and intake ports of the by-pass. On the down stroke the fluid is forced downward through its original course, closing the standing valve and raising the discharge ball, thus discharging the fluid directly into the tubing. It is claimed that the pump will run light on surface equipment as a result of its loose fitting tube construction. This pump is made in both insert and rigid types; the pumping principle in each case is the same, the only difference being, as the names imply that with the insert type it is possible to pull out the entire pump with the rods, whereas with the rigid type, only the outside travelling tube and plunger can be pulled with the rods, it being necessary to pull tubing to secure the standing valve and by-pass assembly.



Merla Flow Valves may not be a cure-all for every well that has ceased flowing, but it is surprising the high per cent of "cures" that have resulted from Merla installations.

A copy of the Merla Booklet, containing an interesting discussion of gas-lift operation, and illustrations and description of Merla Flow Valves, mailed promptly on request.

MERLA TOOL COMPANY

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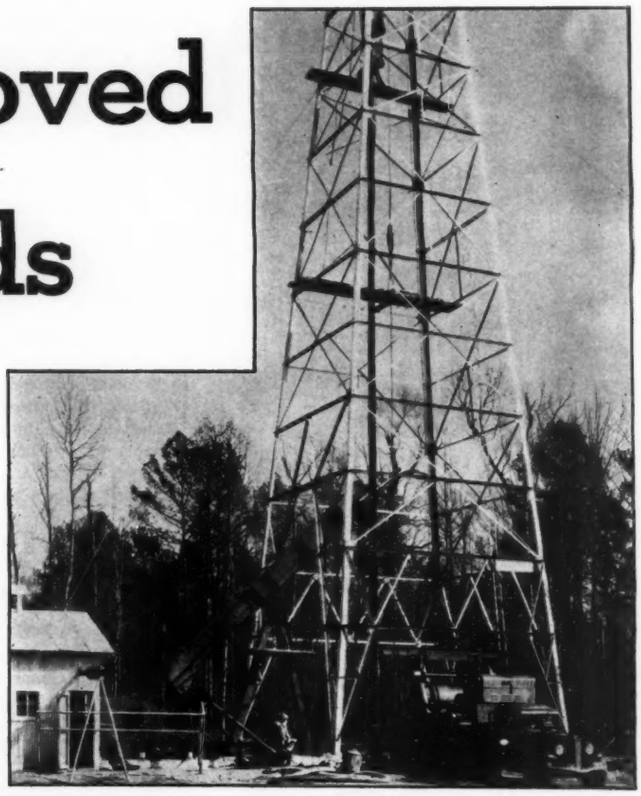
P. O. Box 2576 Dallas, Texas

MERLA *Gas Lift* FLOW VALVE

TUBING FLOW CASING FLOW INTERMITTERS

Cost of Well-Servicing Cut Through Improved Repair Methods



In this Rodessa well, rods are suspended in thribles by a rod hanger in the derrick, cutting down time of rod jobs and preventing damage to rods through a minimum of handling

Improved methods of servicing pumping wells have occupied considerable attention of operators during the past few years. Greater economy has resulted from decreased time required to pull rods and tubing, thus adding to production in unprorated fields. Application of better engineering and safety practices in handling such work contribute to longer life of equipment and greater safety for crews.

Care in handling rods while going into the hole prevents recurrence of many jobs and adds years to the life of equipment

From the original methods of pulling wells, employing bullwheels driven by a bullrope from the tugwheel, the modern portable pulling units are a vast improvement. Through a gradual evolution the old methods gave way to high-speed drums added to the bullwheel shafts to speed up the work.

Next came the calfwheel method of pulling, with the advent of rotary drilling, since the calfwheel was used as auxiliary equipment on most early rotaries. Gearing up the calfwheel gradually cut the servicing time on pumpers. While installations of these types of pulling equipment can still be seen in the older shallow fields, where low production and light loads make more modern installations unnecessary or uneconomical, they have been all but supplanted by the permanent hoists or by portable units on wells where pump units do not include pumping installations.

Individual pulling units, in turn, are now being replaced to a large extent by portable winch trucks or tractors. The general adoption of this latest type of equipment is so general and widespread that it is of the greatest single factor in present-day development of pulling practices.

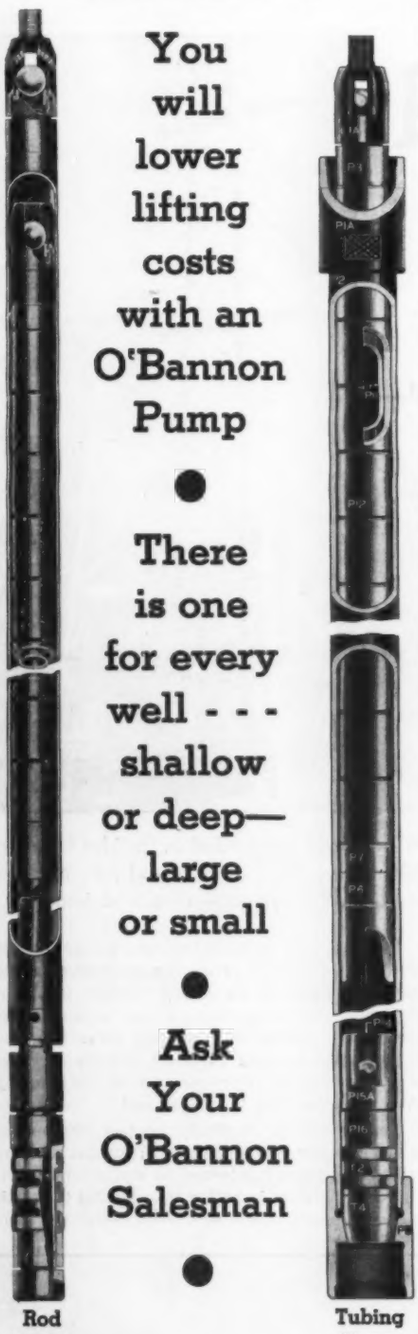
The use of a satisfactory pulling unit, which is easily moved from well to well, eliminates the necessity of maintaining expensive permanent units at each well. Rapid deterioration of such equipment, which performs perhaps one day in one hundred, makes returns on the investment very unsatisfactory. Today, depending on the frequency of pulling jobs and the depth of the producing horizon, compact portable winches can care for the servicing of as many as 100 wells at a fraction of the cost of the former installations.

The methods of handling rods in pulling jobs vary with the type of equipment being handled and the length of the string. Where producing formations are deep, and rod load is correspondingly heavy during the pumping operation, close inspection and extra care are required in handling, to minimize the recurrence of rod breakage after operation has been resumed.

The results of carefully applied engineering in determining correct length of stroke, size and speed of pump and selection of equipment can be voided by careless handling in servicing the wells. In this respect much new equipment has been

Portable well-servicing unit as used by Ohio Oil Co. in Noble field of Illinois

ROD and TUBING PUMPS



You will lower lifting costs with an O'Bannon Pump

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There is one for every well - - - shallow or deep—large or small

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Rod Pump

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Manufactured by

WALTER O'BANNON COMPANY

Tulsa, Oklahoma

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Rod and Tubing

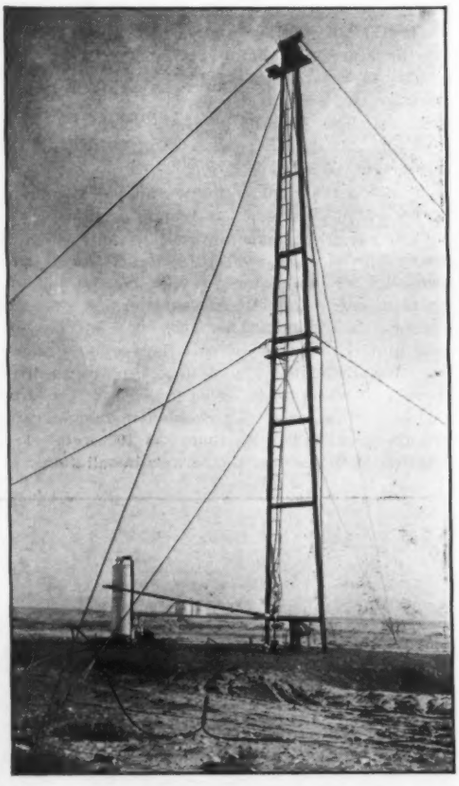
PUMPS

offered by manufacturers, facilitating the easier and more rapid running of rods.

Where standard pumping derricks are installed the rod basket or rod hanger is now becoming universally used. Rods thus suspended in the derrick during pulling jobs are saved much extra handling; nicking, kinking and damage to boxes is largely eliminated. In addition the time saved in suspending two or three joints of rods in the derrick, as compared with laying each joint down singly, is a most important factor.

A further time-saving device used by contractors in many cases is a small auxiliary elevator used by the derrick man. Operated by a hand winch, this extra elevator handles the sucker-rods in and out of the hanger or basket, thus utilizing the time during which the main elevator travels between the derrick man and crew on the floor. In coming out of the hole with the rods, the derrick man releases the main elevator as soon as the slips are set, picks the stand and places it in the hanger while the block is travelling down for the next joint. Likewise in going back into the hole, the time required for the elevator to reach the top of the derrick is utilized in lifting the next joint with the auxiliary, to be stabbed on the string. On wells which pump deep production, the resulting cut in round trips is very appreciable; particularly important to contractors whether contracting per well or by the hour. Where the derrick over a pumper is not heavy enough to allow the use of rod baskets, rods are laid on specially constructed walks or racks. These should be kept clean and should support the rods throughout their length to prevent kinking or bending. When rods are laid down in this manner they are handled singly, and are always heeled back into the derrick so that the box does not fill with dirt.

Careful inspection of the rods while coming out of the hole is advisable, often resulting in



Large type steel mast built in the Jal field of New Mexico for pulling of rods and tubing by servicing unit

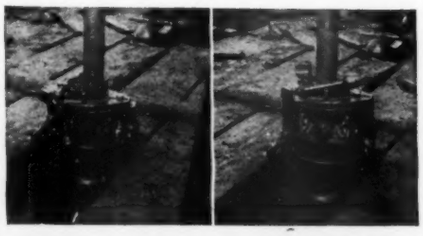
the spotting of a damaged joint or a worn rod which saves a later rod break and pulling job. Where the practice of hanging rods in the der-

AUTOMATIC TUBING SPIDER

PROVIDES SAFETY! AT ALL TIMES!

Coming out of the hole, any downward motion of the tubing, whether intentional or accidental, sets the slips. Going in, the slips can be set as quickly as a man can drop a red hot iron, and the gang stands safely clear at all times. This means time, money, and equipment saved—any maybe a life!

Fits any casing head. Handles all sizes of tubing. Recessed bowl allows instant disengagement of slips and prevents wear. Steel throughout, with all wearing parts heat treated. Simple in construction, simple to operate.



In the illustration above, an O'Bannon Spider is shown in operation. At left, spider is engaged and supporting tubing. At right, spider is in released position and tubing is suspended on elevator not shown. (Pictures made at Oklahoma City on a 6,800 foot well.)

Don't talk about safety. Practice it.

Use an O'Bannon Automatic Tubing Spider.

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Tulsa, Oklahoma

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Safety

TUBING SPIDER

rick in doubles or thribles is followed, the intermediate joints should be set on the elevator and snapped up. It is good practice, particularly in deep or crooked holes, to change the length of the pony rod above the pump, varying the position of the rod couplings in the hole, and cutting down localized tubing wear. In some cases cathodic protectors, commonly made of zinc, are used on boxes to curb wear in crooked holes.

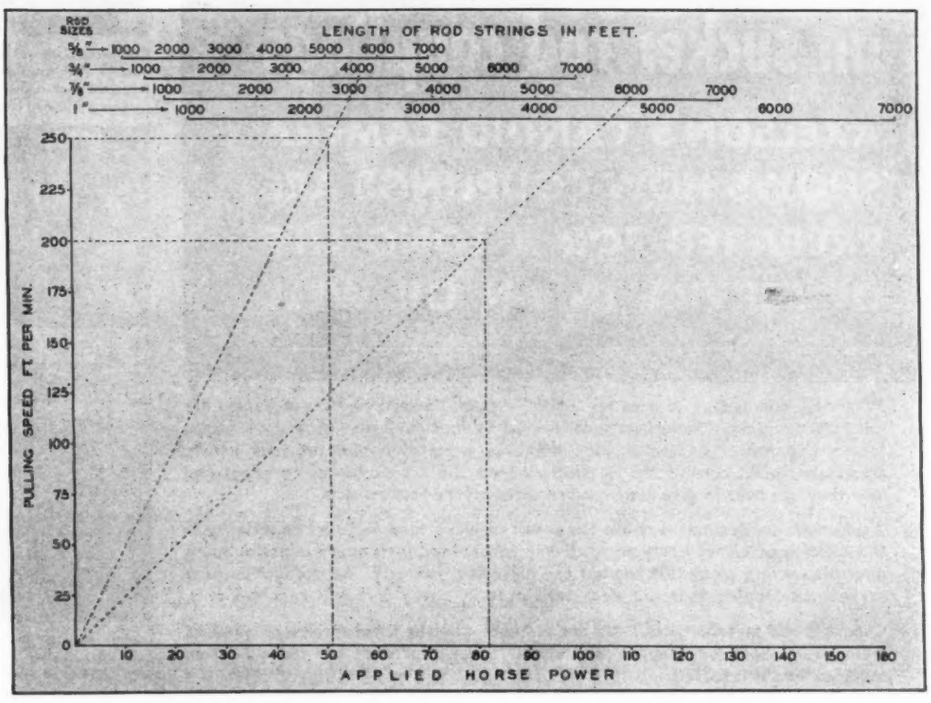
In going back into the hole the regular precautions in running any string are followed. Thorough cleaning of each joint with a steel brush and light oil and greasing with zinc thread lubricator is standard practice, and very important on a working string. Care should be taken to prevent cross threading, particularly when the rods are hung in thribles, and when threads appear to be damaged they should be checked with thread chasers and replaced if defective.

Breakage Studied

A practice which is helping to solve many rod troubles is that instigated by a prominent rod manufacturer, whereby samples of rod breaks are sent into the company's laboratories for examination. Followed by a well inspection by the company's representatives, who check details on pumping operations, pulling and rod breakage, this system of scientific solution of rod troubles is proving very effective.

The recurrence of rod failures in certain wells should be studied carefully in an effort to determine the causes and if possible to remove them. In many instances a longer and slower stroke will lessen the stresses on rods and contribute to longer life. On this subject the operator has access to the results of exhaustive scientific research on maximum allowable working stress of rods of various types, and actual stress conditions in pumping wells, as influenced by depth of well, gravity of the oil, diameter of the pump, length and period of stroke and other factors.

The effect of hammer, corrosion, and most effective period for rod strings of different lengths and materials must be given attention if the operator is to gain most efficient results. Hammer or undue shock to rods can be minimized often by changing the period or length of the stroke. Use of rubber cushions supporting the sucker-rod string will sometimes correct the shock condition, provided the load is not too great for the rubber to retain its life over a reasonable period.



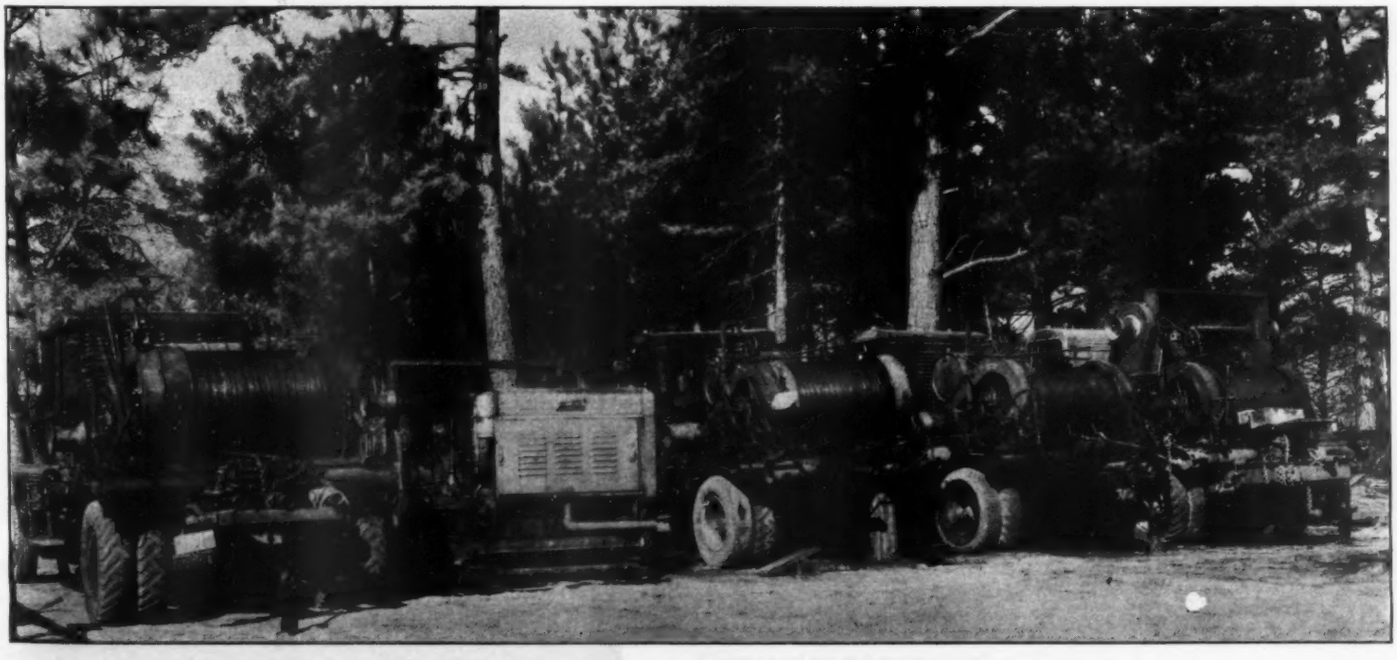
Graph showing power needed for pulling various rods

Correction for rod troubles by decreasing stroke, speed or pump diameter cuts the daily production of the well. However, in some cases a balance can be attained and the undesirable condition eliminated without decreasing any one factor enough to appreciably affect the production.

In fields where proration is scheduled on regular schedules the pumping equipment should be selected to care for the maximum prorated production, with provisions for moderate variation in case of changes. Where allowables are large enough to make continuous pumping economical such operation is desirable, especially where paraffin trouble is risked by daily shutdown. By adapting pumping requirements to allowable production, equipment and pumping operations can be designed to create minimum stress on rods, resulting in considerable freedom from maintenance trouble.

Time Element

The time element in pulling wells for rod jobs is important from several angles. In modern practice where one portable unit serves many wells, the shorter the time on each job the greater the number of wells which one unit will service, making time a factor of investment cost. Where proration is not practiced on pumping fields the downtime on a well represents lost production which cannot be made up, since the well is producing at maximum economical operation. This



Heavy winch trucks used by contractors in many fields reduce rod and tubing pulling to a very efficient and economical operation

LIFE IS TOUGH
on sucker rod couplings

AXELSON'S CANDID CAMERA SHOWS HOW COUPLINGS ARE PREPARED FOR A LONG LIFE OF SERVICE IN AN OIL WELL

Wherever man pumps oil from the earth, Axelson Deep Well Plunger Pumps are busy night and day. Sucker rods, connected by hardened and ground couplings, join motive power on the surface with the pump thousands of feet below. Axelson's candid camera shows, step by step, the production of couplings and how they are built to give longer, more satisfactory field service.

Axelson production methods are the result of more than 46 years experience in the building of oil well equipment. Every laboratory test, every manufacturing operation, every plant test has but one objective,—namely, the production of a sucker rod coupling that will meet satisfactorily every field test required of it.

Chemical and metallurgical tests are made in Axelson laboratories on samples from every heat of coupling bar stock. Stock that does not meet Axelson specifications is rejected.

14

Each coupling is placed on an accurately threaded mandrel and faces are ground square with the thread. Thus Axelson reduces to a minimum the possibility of fatigue strains which reduce service life.

1

Wafer thin samples are cut from every piece of bar stock from which couplings are made and acid etched to verify specifications and to reveal any flaws existing in the raw material.

2

Blanks are placed in nichrome boxes and covered with carbonacious material, then heated in electric furnaces to carburize the surface to the proper depth of the coupling blanks.

3

Several specimens from each box are tested for depth of case which controls the depth of hardness of the finished couplings.

THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

4

Carburized blanks roll down the trough into this machine which automatically drills, rough reams, faces, and forms the radius of one end. The same process is repeated on the other end.

5

Wrench flats are next milled before couplings are hardened. At this point each coupling has been inspected six times and must pass seven more inspections before completion.

6

This automatically controlled furnace provides the particular heat treatment previously determined by laboratory test. After heating the couplings pass on into the quenching tank.

7

Drawing of couplings in the homo electric furnace relieves quenching strains. The carburized area is now very hard, offering greater resistance to abrasion and friction.

8

Immediately after the drawing operation and before the couplings are finished several couplings are selected at random from each lot and tested for Rockwell hardness.

9

Centerless grinding makes each coupling smooth, essential for frictionless operation within the tubing. Couplings are again inspected before they are passed on for finished machine work.

10

Form reamers (same length as coupling) finish each end and I.D. This operation assures the cone and bore being in alignment and also square with faces.

11

Between reaming and tapping all blank couplings are gauged with a blank taper gauge to verify that the reamed blank is perfectly concentric with each end and that the cone is correct.

12

Taps are run completely through the coupling on multiple spindle geared drill presses. The taps are released so that it is unnecessary to back them out risking distorted threads.

13

"Go" and "no-go" gauges hold Axelson couplings to rigid allowable A P I tolerances. Couplings are made up with Axelson rods at the plant to greater tension than they will meet in service.

15

A feeler gauge is used to inspect the faces of the shouldered couplings and to assure that these faces are square with the axis of the threads.

16

The couplings are washed in a hot spray washer and dried, after which they are dipped in a protective solution for rust prevention. They are then boxed for shipment.

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in turn decreases the returns on the investment in the well.

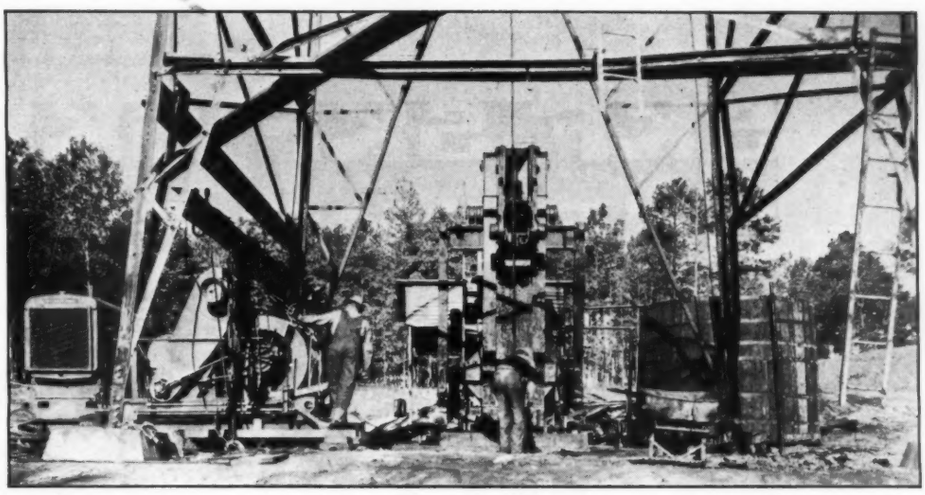
In the larger pools where production depths and pumping conditions require the most modern and the heaviest of equipment, pulling and servicing contractors find an important field. Whether the contractor is taking work on the time- or unit-basis speed is essential, as equipment of contractors will illustrate.

The pulling of tubing for reasons other than tubing failure is rapidly being eliminated through use of insert pumps which are pulled with the rods. This saving of work is an important factor in cutting down time, and in decreasing wear and risk of tubing failure.

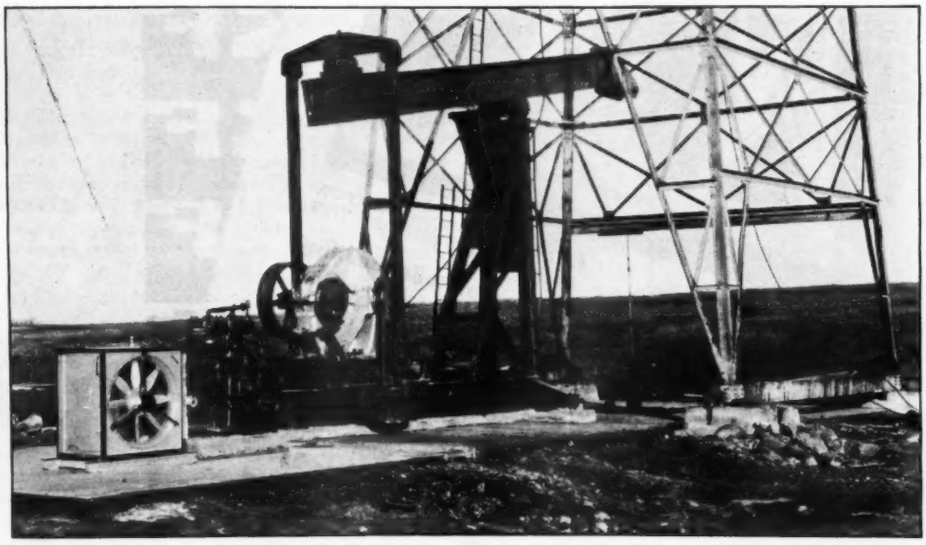
Selection of powers for pulling units is relatively simple. The principal manufacturers of such engines have numerous examples of their units successfully operating on all varieties of wells. The winch operator can attain a wide range of operation with use of varying gear ratios, lines overhead, and speeds on the motors themselves. The variables to be considered in choosing a power for a certain job are so many that only the most generalized conditions can be stated on first inspection. In terms of horsepower, however, the power required to pull a known string of rods a required number of feet per minute can easily be determined.

The accompanying chart gives a basis on which to determine what power is required over a wide range of operations. While power required to pull rods a constant speed decreases as the string comes out of the hole, the maximum power will be on the first stand. For example, if a speed of 200 feet per minute is required in starting a string of seven-eighths inch dry rods out of a 6,000-foot well, the horsepower applied directly to the string can be determined as follows: A diagonal line joining the 6,000-foot point on the seven-eighths inch rod scale, and the origin of the graph represents all combinations of speeds and powers for those conditions. For 200 feet per minute a horizontal line, extended to the diagonal and imposed downward on the power scale, indicates that 82 hp. is being applied to the string before the first stand is broken out.

Likewise a string of three-fourths inch dry rods will require 51 hp. to bring them out at a starting speed of 250 feet per minute. It should be emphasized that the horsepower represented is actual applied power to the string. The friction in wire rope, sheaves, reduction gears and other moving parts cuts the efficiency to a fraction of the output of the prime mover. A safe efficiency factor to assume is 75 per cent, showing that the first condition would take about 110 hp. This checks with operating examples as 120-hp. units are commonly installed on pulling winches of the portable type in the Rodessa field, where seven-eighths inch rods are used in 6,000-foot holes.



Scene in Rodessa field: This unit is brought out on truck and set down on portable skids



Construction view of cooler and unit. Located in Lincoln County field of Oklahoma

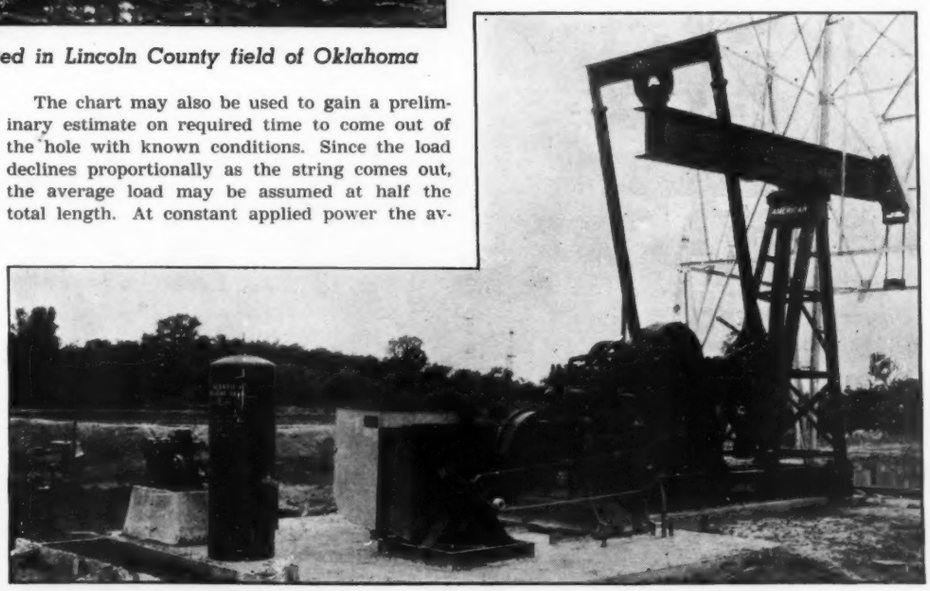
The chart may also be used to gain a preliminary estimate on required time to come out of the hole with known conditions. Since the load declines proportionally as the string comes out, the average load may be assumed at half the total length. At constant applied power the average speed is that obtained on half the string. With known time intervals between each trip of the elevator and the trips determined by pulling in doubles or thribles, a blanket estimate could be found.

However, most operators vary the number of lines overhead as the string comes out of the hole, and the safe points at which this pulling ratio might be changed can be determined by inspection from the chart. Too many variables are involved in pulling rods to obtain a close estimate of pulling time from such empirical data, and the chart's use is obviously limited by the factors of friction, crew efficiency and inspection, repair or replacement during the pulling job.

In going back into the hole required braking power, and allowable stress on lines and other equipment may be estimated from inspection of the chart, and safe gear and pulley ratios determined.

Pulling Costs

Costs of clean-out jobs and rod replacements have been cut considerably through use of portable-type winch trucks serving several leases. In older shallow fields, where production varies from a few hundred feet to 2,400 feet costs will vary up to $25 or $30. On such jobs converted automobile motors with horsepower ratings of 60 or 80 will operate efficiently with correct allow-



Engine-water cooler on foundations and fan-connected unit under construction

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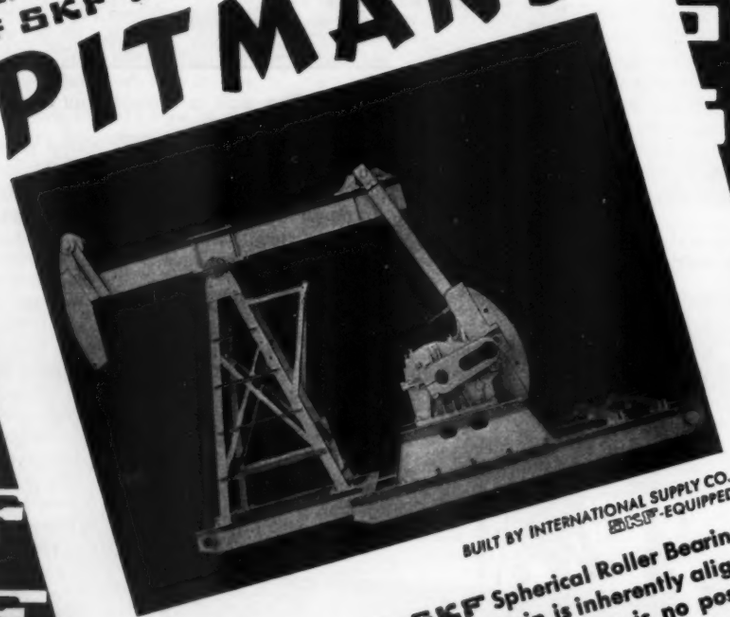

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SKF makes more types and sizes of ball and roller bearings than any other manufacturer in the world.

ance for gear and pulley ratios. Such units are considered too slow, however, for wells of average depth. In the deeper pumping fields where the number of pumpers has become large enough to warrant specialization in pulling and cleaning, the cost of such work averages $80, and in some cases much less.

Lost production, which in unprorated fields cannot be made up, should be included in the cost of cleanouts and rod jobs. This too has been consistently cut by the increased efficiency of adequately powered pulling equipment and specialized experience of pulling crews. On shallow wells down-time may run as low as four or five hours, depending on the amount of work to be done on the string and the thoroughness of the check. In fields comparable to Rodessa down-time may run as much as 15 hours, or a day in cases where cleaning or repair is necessary. However, the increasing number of such jobs which will come as Rodessa goes further to pumping will probably cut the time and cost of pulling rods.

Well-Cleaning Methods

Well cleaning constitutes a major problem in many pumping fields where paraffin deposition on rods and tubing hinders production and menaces equipment. The variety of causes for such trouble gives rise to a wide difference in the handling of cleaning measures. Individual factors in each field and in some instances in different wells of the same pool, may vary, requiring special handling. A number of ingenious methods of cleaning and preventing paraffin deposition have been developed by engineers, pumpers and field superintendents.

Paraffin control is the primary step in combating such conditions. Good engineering requires that attempts to prevent or retard separation of such deposits on wells should first be studied.

The solubility of paraffin in crude oil is determined by three factors. At its melting point, wax is soluble in all proportions in lower-boiling crude oil constituents. As the temperature is decreased the solubility of paraffin in oils greatly diminishes, the point where the paraffin crystallizes out being dependent on the amount of wax and characteristics of wax and oil.

Existence of low-boiling fractions in crude containing paraffin wax is also a factor which determines its solubility. As these more volatile hydrocarbons vaporize out of solution, the remaining fractions show less and less solubility for the heavy wax. This action is further promoted by cooling of the solution as the light constituents vaporize and expand. The presence of water in paraffin-oil solutions is believed to have some effect on their relative solubilities, since water is very slightly soluble in crude oil and thus decreases the solubility of paraffin in the oil.

A study of the effects of these factors on the deposition of paraffin in pumping wells will give the operator a basis for determining how best to combat the trouble. First, the decrease in pressure on the oil column as it approaches the surface tends to allow the lightest fractions to volatilize. This brings cooling, thus paraffin in the less soluble heavier oil may reach supersaturation and crystallize out. In addition, cooling of oil may take place as it flows upward to the surface, accelerated sometimes by passing through a water stratum. Another and common cause of increased paraffin deposition in pumping wells is the agitation of the working barrel in the well. It has been noted that wells which do not pump continuously, but agitate at intervals are more troubled with paraffin.

Aside from the principal causes of wax formations in pumping wells, other conditions tend to influence it. A hole full of oil will stay clean longer than one where the tubing and rods are exposed intermittently as the well heads. As the oil runs back down the surfaces of tubing and rods, the paraffin which crystallizes out becomes firmly deposited. This is prevented to a large extent when oil is in constant contact with tubing and rods throughout the length of the string.

Preventive Measures

First steps in controlling wax in wells are to obtain if possible a steady flow, as against heading or agitating, and to keep the hole filled with oil. In some cases it is profitable to hold a back pressure on the wellhead to prevent the separation of gas and light fractions from the crude on its way out of the hole, thus maintaining the solubility of the paraffin in the oil. In many cases, however, particularly in old fields which have been on the pump for several years, the gas factor is absent and none of the precautions outlined will reduce the trouble. This also holds for newer fields where a large amount of gas is produced with the oil, and separation and expansion cannot be prevented. However, such fields are not generally on the pump and may be omitted from consideration.

Fields which present paraffin trouble early in their life usually require more attention as production continues. The percentage of gas and light crude fractions declines generally with the age of the field, and the remaining heavier crude shows less and less solubility of the paraffin constituents. This is particularly true when wells go on the pump and are pulled to any extent.

While preventive measures are the first to be applied to the paraffin problem, their usefulness is limited and eventually most operators must resort to removal of paraffin after its deposition on rods and tubing has unavoidably taken place. Principal success in this type of work has been attained through use of various solvents. These may include commercial chemicals especially designed to cut the wax, well known solvents

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Pure Oil Co.'s big-wheel tractor pulling unit as seen in the Clay City field of Illinois

such as carbon tetrachloride, or straight gasoline and distillate. The latter is finding increased use, especially in fields where supplies of casinghead gasoline are available in sufficient quantity.

Application of solvent to the well varies with severity of the paraffin deposition, type of fluid employed, and individual practices considered best by various operators. In cases where trouble is relatively slight the solvent may be lubricated into the casing of the well in small quantities at regular intervals, thus cutting the wax already formed and at the same time preventing subsequent deposition. This dilution of crude, in addition to cutting paraffin trouble in the well itself, carries over to flow lines and storage and prevents much additional trouble from plugging and congealing after the crude has been produced.

The advantage in using the stronger commercial solvents is found in their effectiveness in small quantities and the reduction of down-time in treating. They may be poured into drained tubing in blends of oil or water, or may be introduced straight. Some solvents, being much heavier than the oil produced are admitted to the top of the tubing string, which is still filled with oil, the solvent working downward and dissolving the wax. Shut-down time with such treatment may vary from one hour up to five or six hours depending on the severity of the trouble. Occasionally, when deposition is so great that the pumping has been decreased to a small fraction of the normal operation, the solvent is introduced into the drained tubing with the pump operating. As the wax is cut, the pump will gradually increase operation, aiding the solvent by agitation. Drainage of the tubing may be accomplished in some types of pumps by use of a tubing bleeder, which is controlled by the polished rod clamps. In the severe cases of paraffin trouble just cited, the dissolved wax is pumped to waste or pits where it will give no further trouble in lines and tanks.

Petroleum Solvents Successful

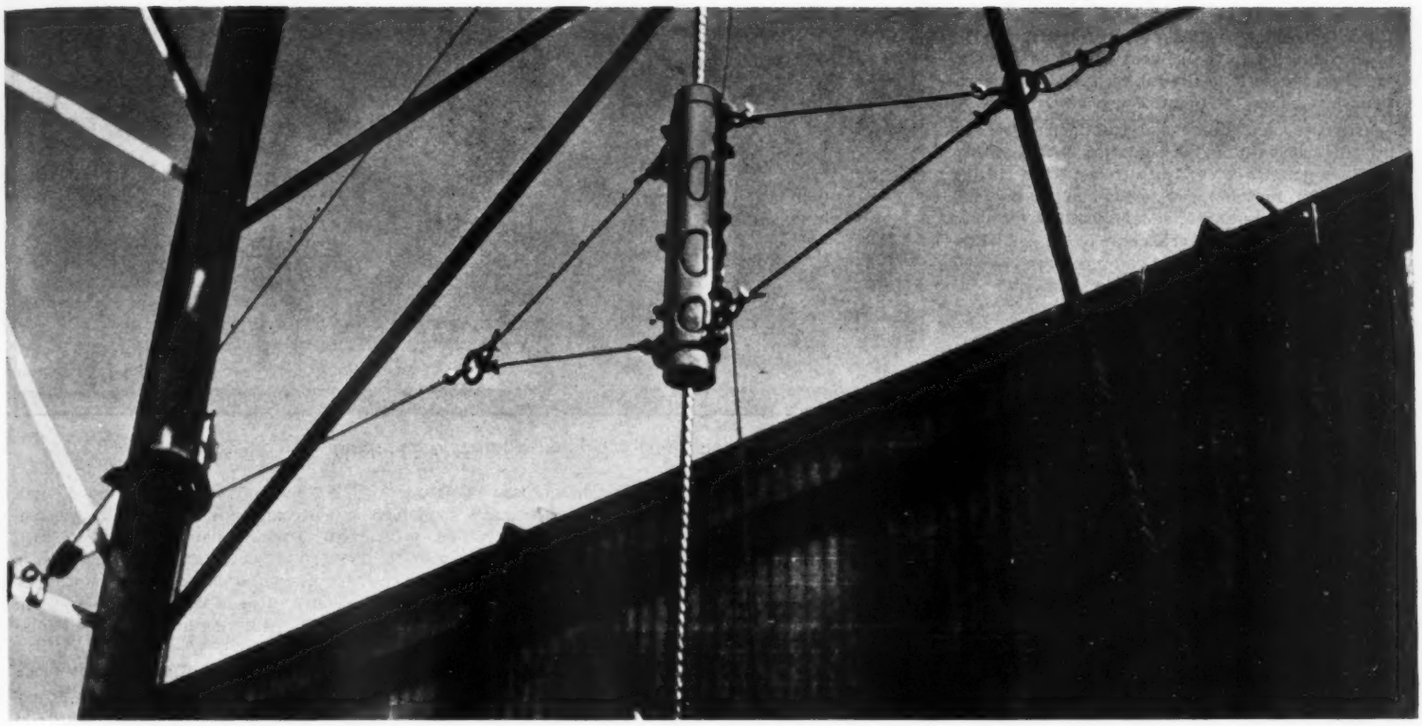
A major operator in a large Mid-Continent field has developed a successful method of combating paraffin trouble by consistent use of a light petroleum solvent, which is available in large quantities in the field. When production on a well declines below an optimum point, due to wax deposition on tubing and rods or flow string, a portable treating unit is moved to the site.

If the well is producing through the tubing, connections are made at the top of that string and the petroleum solvent is pumped in from the tank truck, the volume dependent upon the severity of the trouble. When the solvent reaches the bottom the well is again placed on production and the solvent is carried to the top. Again the well is shut in, and the solvent slug returns to the bottom. By means of this surging or rocking, repeated as many times as believed necessary, the paraffin is sufficiently removed and the solvent with paraffin in solution is run to storage as marketable oil. Down-time is reduced by surging and more rapid solution of wax. The combined solvent and solute may be safely run to storage with little subsequent trouble from plugs or tank bottoms.

Numerous methods of introducing the solvent to the well while it is on operation have been evolved. These methods, while requiring more equipment, and entailing less solvent efficiency due to dilution by oil, have as their principal advantage the elimination of down-time.

In many cases the wax deposition takes place only in the top few sections of the tubing where gas has expanded sufficiently to cool the oil, or where a cooler stratum has been encountered. When the section consists of only a few hundred feet, success in removing the paraffin may be obtained through introduction of solvent just below the point of deposition through an individual line run into the well between tubing and casing. This need be no larger than three-fourths inch macaroni tubing. A special coupling at the point of introduction to the tubing, together with a solvent tank and connections are the only equipment needed.

In similar cases of paraffin trouble another method of treating has been found successful. Instead of employing a separate string to run the



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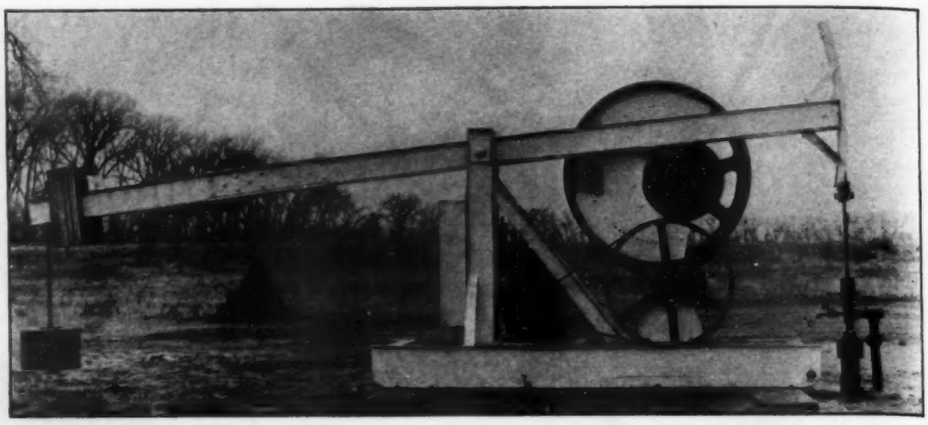
solvent, a string of heavy 1-inch pipe is substituted in the top section of the rod string. The pipe, connected to the solvent supply at the surface, introduces it to the tubing through perforations just below the point of deposition.

The use of distillate and gasoline, which has proven successful in these latter two methods, must be gauged correctly to prevent the cutting of paraffin in the lower section of tubing and subsequent deposition in added quantities at some point above, due to overloading of the oil. Frequent treatment and use of sufficient solvent will insure success, and conditions in each well will determine the correct frequency and quantities of solvent necessary.

Although heating methods have been attempted in many variations, their success is not as outstanding as that of solvent usage. Introduction of heat by steam or hot oil is definitely limited. Some operators have had success with steam, by running a 1-inch steam line into the well and blowing it under a pressure of 120 pounds for several hours, depending on the amount of wax deposited. This method is unsatisfactory from the standpoint of down-time. In addition, depths exceeding 600 to 700 feet cannot be successfully reached by the steam before it loses its heat and has condensed. Further trouble may be encountered by emulsion of the condensate and oil. In blowing wells thus, the melted paraffin, oil and condensate must be pumped to disposal, as running to storage would cause much paraffin trouble as soon as the stream cooled.

Hot oil eliminates the risk of emulsions, but its effective depth is much less than that of live steam, and its success is obtained only in wells troubled with light wax deposition at shallow depths. Chemicals which react with water to produce heat are used in some instances with success, being introduced to the bottom of the well, and allowed to heat the oil flowing to the surface.



Friction-roller type unit operating pumping well in Kansas

Another method of applying heat to the flowing oil in order to melt paraffin from rods and tubing employs electric heating elements which can be lowered into the well. This method obviously is economically possible only where a ready supply of cheap electricity is available throughout the field. Flame heating at the bottom of wells has been developed to combat paraffin formation on strings and sand surfaces. This is accomplished in a small burner which is lowered to the well bottom and connected with lines supplying proper proportions of gas and air. This practice is used mainly in heating sand surfaces and its application is very limited; success in even such cases being highly problematical due to formation of tarry materials from burned oil and boiling off of lighter crude fractions, leaving heavier constituents which have even less solubility for wax.

In thousands of wells operating at marginal production, such methods as outlined above entail too much expense and down-time to be economically utilized. The standard practice in such cases is the use of paraffin knives and hooks. These can be run on rod strings after removal of the working valve. Use of solvent in connection with such mechanical methods is sometimes feasible.

Operators in older fields giving continuous paraffin trouble resort to a regular routine of pulling rods and cleaning mechanically. In some fields, such as the Caddo area, operators may pull and clean a well as often as each 15 days. Portable winch trucks powered by small economical gasoline engines can service a large number of such wells. The short down-time, and small cost makes such methods economically possible in marginal fields where possibly more effective methods are not justified by the small production returns obtained.

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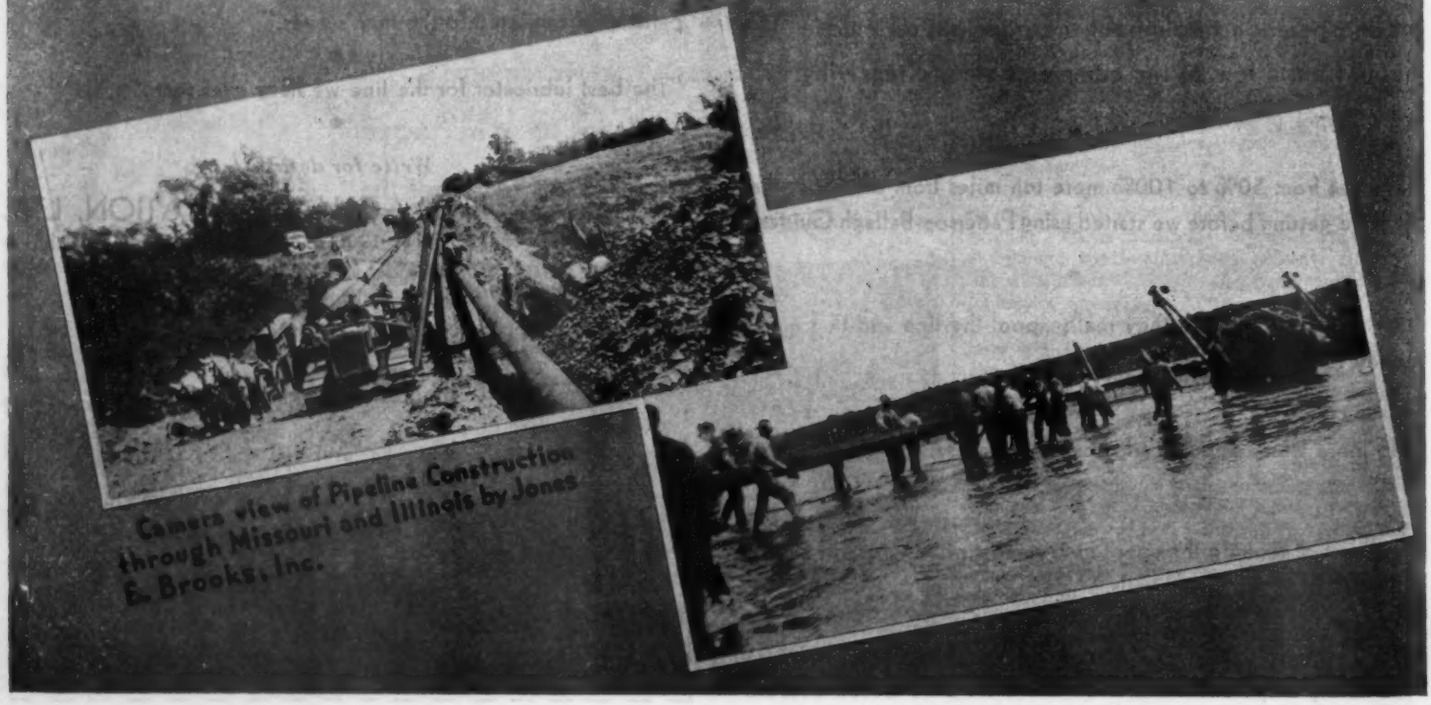

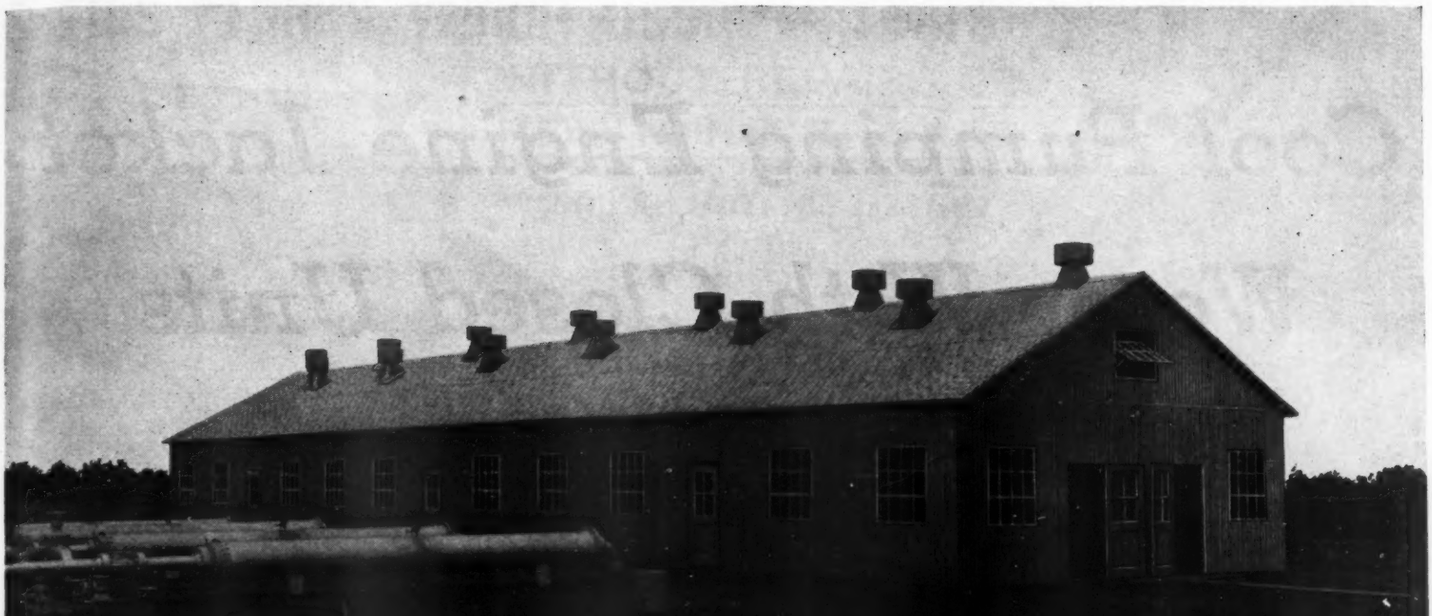

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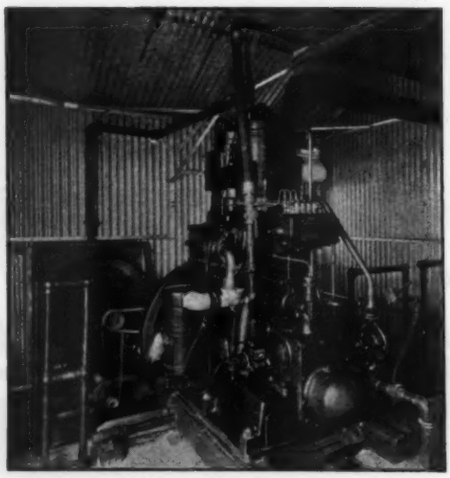
Cool Pumping Engine Jacket Water With Closed Units

By PAUL REED

The cooling of jacket water of pumping engines at individual wells and central powers received more attention during the last year and a half than ever before in the long period during which the industry has been using internal combustion engines. This has come with the widespread application of the closed type cooling system, equipped with radiator and fan, which was given considerable impetus by the interest attracted to the display of this kind of equipment at the International Petroleum Exposition in Tulsa in May, 1936. Since that time the number of these units sold in the Mid-Continent alone has run into the thousands. When confronted with the opportunity of using these units, especially designed for eliminating some of the difficulties connected with the cooling of slow-speed engines, production engineers and superintendents have given considerable thought to analyzing cooling problems to determine whether to adopt this innovation or to continue with the time-honored practices of the past.

Back in the latter part of the last century when gas engines displaced steam engines in the pumping of oil wells, there were no radiators, as we know them today, because they were developed later to meet the needs of the automobile. The situation being as it was, cooling was done with the same kind of tank that had been used in supplying water to boilers. Cooling was accomplished as the result of evaporation from the fairly large surface of water exposed to the air. In some cases this has been augmented by additional aeration furnished by having the water spray out through a perforated nipple or from the open end of upright pipe, or by having it trickle down over baffles in a miniature cooling tower.



Cooler driven from vertical engine by means of double sheave

Essentially this method has continued unchanged for half a century. From time to time radiators and fans available on the market were found to give satisfactory results at different points where they were tried. About 12 years ago there was enough experimenting along this line to indicate that radiator cooling might soon be generally used. But objection was raised on the ground that serious overheating might occur as the result of belt breakage or loss of water and it was considered to be safer to have the engine jacket connected with a good size water tank. Since then the efficiency of radiators has been increased to a marked extent and, furthermore, most of the cooling units now sold for this service are especially constructed for oil-field conditions. Nevertheless, opposition to these units continues today in certain organizations, some of them among the largest in the industry. However, in the Mid-Continent a survey shows that most of the major companies have been purchasing radiator coolers to an increasing extent during the past year.

Classification of Units

Before mentioning results obtainable, types of equipment, and installation practices, it may be said that there is a difference of opinion as to the correct way to designate these units as a class. While some manufacturers think such a unit may properly be called a radiator cooler, others think it would be preferable to use such terms as cooler, water-cooling unit, or engine jacket water cooler. Manufacturers actively engaged in the manufacture of these units for distribution in the Mid-Continent are Driftmeter, Inc., Charles J. Franks Co., Happy Belting Co., O. & G. Manufacturing

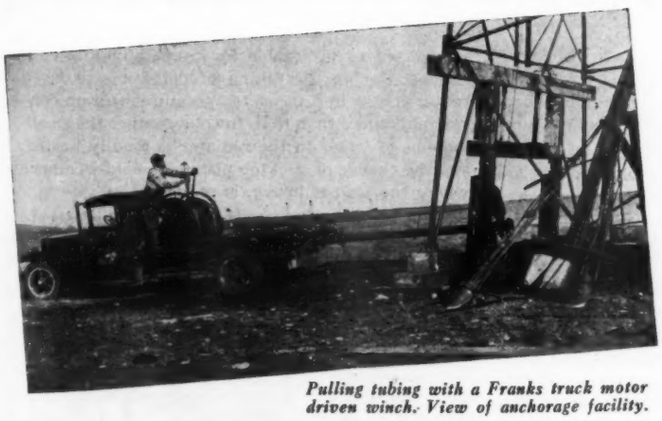
Interior view of rig front pumping unit with radiator cooling equipment

This Franks Winch Used 4½ Years

WITHOUT REPAIRS OR RELINING BRAKES

—says *Charles Fisher* of Oilton

Charles Fisher of Oilton, Oklahoma at the controls of his Franks Junior Winch which he has used for 4½ years without repairs or shutdown—he hasn't even had the brakes relined.



Pulling tubing with a Franks truck motor driven winch. View of anchorage facility.

Not only do Franks Winches stand up, but they are acknowledged the fastest, most efficient and most economical winch units for shallow to deep wells. The largest producing company in the Oklahoma City field, servicing several hundred wells, claims Franks units do the job in less time and effect the greatest saving.

FRANKS SEVEN EXCLUSIVE ADVANTAGES

1. FASTEST ANCHORAGE AND LEAST HOLD-DOWN EXPENSE. Just back Franks truck motor driven winch back into location and anchor at any point on or inside of derrick or mast by means of horizontal telescoping boom. No floor block necessary.
2. FINAL DRIVE FRICTION CLUTCH. Eliminates shock loads and therefore keeps repair to unit at minimum.
3. MOUNTS UPON ANY TRUCK 1½ to 10 TONS. Easily installed at little cost. Power take-off proven success with over 700 units in field, all of which are still operating.
4. FULL TRUCK CAPACITY AVAILABLE. Winch directly behind cab leaving bed for tools or general truck use.
5. LESS WEIGHT AND BETTER DISTRIBUTION ON TRUCK TIRES.
6. LOWER CENTER OF GRAVITY.
7. HANDLES MORE JOBS IN SAME TIME, due to quicker anchorage facility and greater maneuverability.

Write for complete information or see the Composite Catalog.

766 FRANKS WINCHES BUILT —EVERY ONE STILL IN SERVICE

Franks final friction drive well-servicing units are the fastest for location to location moving. Fastest anchorage. Fastest rig-up. Save shutdown time. Exclusive anchorage facility saves thousands of dollars. Employed by nearly every major oil company in the Mid-Continent and Gulf Coast areas. Over seven hundred winch units built and every one still giving satisfactory service today.

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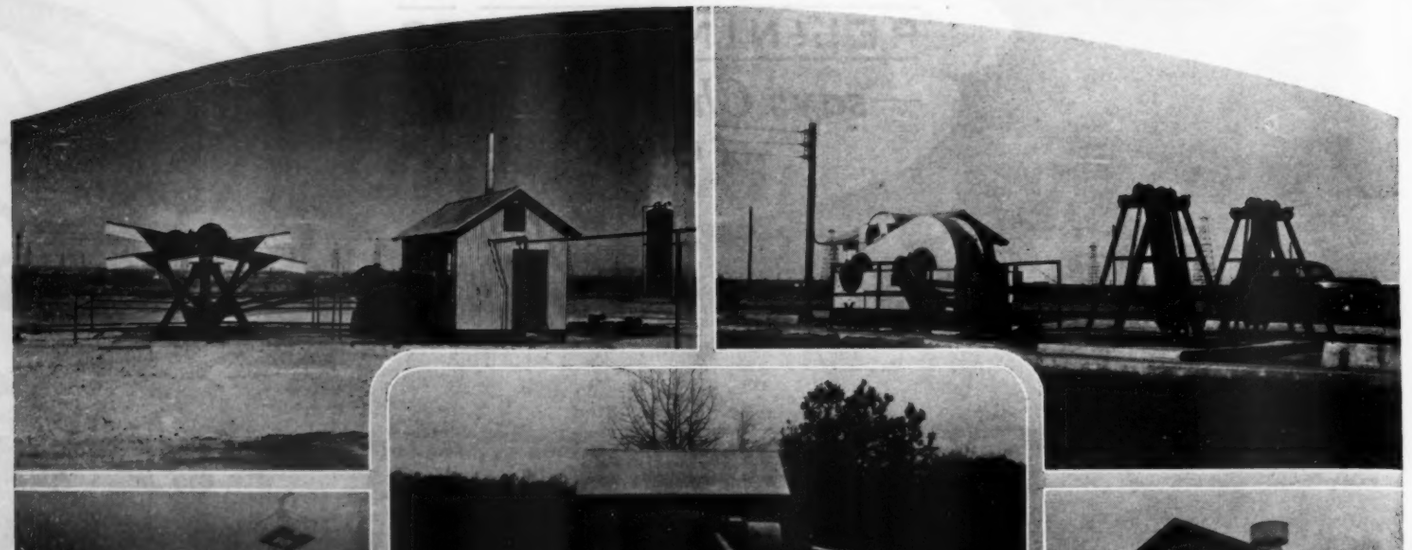
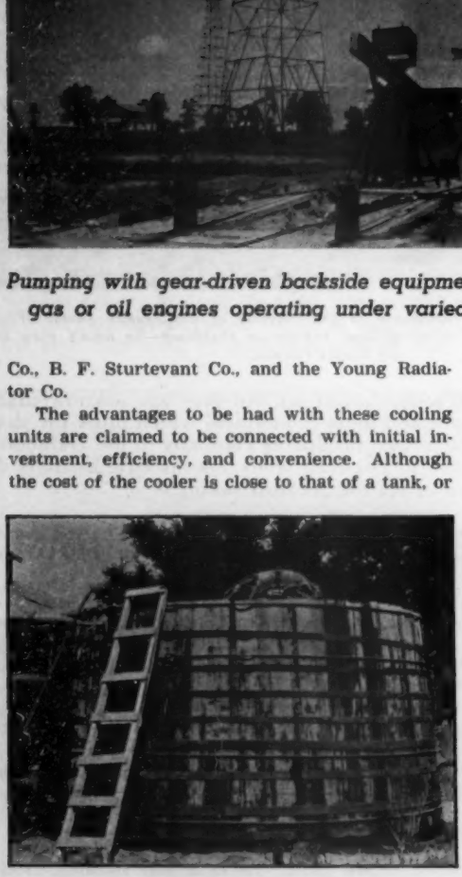


Pumping with gear-driven backside equipment is one of the important phases of field operations. The equipment is often powered by gas or oil engines operating under varied climatic conditions where adequate provision must be made for cooling-jacket water

Co., B. F. Sturtevant Co., and the Young Radiator Co.

The advantages to be had with these cooling units are claimed to be connected with initial investment, efficiency, and convenience. Although the cost of the cooler is close to that of a tank, or



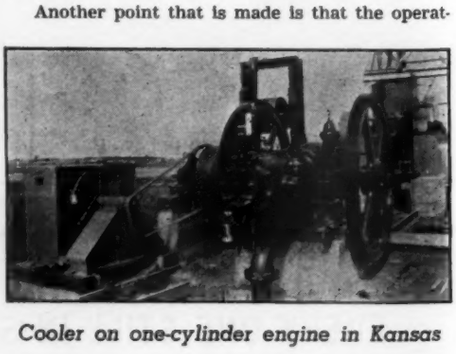
Cooling by open tank aeration

even more, investment savings are claimed through the elimination of water lines and the other necessary provisions involved in supplying the quantity of water required by conventional cooling methods. From the standpoint of effective cooling, it is asserted that with tank cooling the engine is kept too cold in winter and too hot in summer, while with the radiator type cooling units it is possible to keep the temperature of the engine somewhere close to the one at which the engine manufacturer intended the engine should run.

Furthermore, it is said that scale deposits are much reduced not only by maintaining lower jacket water temperature in hot weather but also because the smaller quantity of water used in the radiator coolers means that less scale-forming material in solution is passing through the engine daily. Since there is seldom need for more than a few pints of make-up water to be added to a cooler each day it is practicable to transport this from a desirable source, in localities where water is bad. If water treatment is advisable it can be provided readily. In winter, radiators are kept from freezing by the use of antifreeze materials. By operating the engine at the optimum temperature, through the elimination of scale, it is possible to lubricate the engine better, to save cylinder wear and cylinder head breakage. It is said that three cylinder head breaks will pay for the cost of a radiator cooler.

There has been a belief on the part of many pumpers that the cooler the engine was kept the better it would run. And it appeared that ideal conditions existed when there was a whole tankful of cold water to be warmed up. A temperature of 60° F. or below was thought to be desirable. Temperatures between 110° and 120° F. are now recognized as preferable for usual pumping conditions. During the taking of potentials to meet requirements in Kansas, temperatures run up considerably more than that. In cold weather the small amount of water in the radiator is readily heated and the chance of sticking pistons in cold weather, where the load is heavy, is reduced.

Another point that is made is that the operating conditions within the engine may be concealed to a certain extent where cooling is done with a tank because, as piston rings wear, the dissipation of heat consequently decreases but the dissipation of heat increases with the formation of scale deposits. Radiator type coolers make especially good showings for themselves where water is scarce or of poor quality. Where rainfall can be de-



Cooler on one-cylinder engine in Kansas

pended on, rainwater caught from the roof gives a sufficient supply of make-up water. Some operators use distilled water entirely for make-up water in order to keep the water jackets altogether scale-free. Furthermore, it is asserted that the enclosed nature of these coolers reduces aeration and thereby gives less chance for evaporation and the formation of scale.

Considering the length of time that radiators have been used on automobiles, trucks, and stationary engines, and considering the great increase in efficiency which has been achieved in the last few years, it is surprising there should be such a variety of ways for designing these cooling units. To begin with, the fans of some units are of the pusher type, while the fans of others are of the suction type. These fans are made with three, six, or eight blades, depending upon the preference of the manufacturer. In design, fans may be made like a marine propeller, or an airplane propeller, as well as like the conventional fans used on the radiators of automobiles.

Fan speeds vary from 650 r.p.m. to 1,200 r.p.m., and the horsepower required to drive them differs considerably between the coolers of different manufacturers. One manufacturer has stated that the horsepower necessary to drive the fan increases according to the cube of the percentage of the speed. For instance, if the speed of the fan were increased to twice that of normal speed, 16 times the horsepower would be required to drive the fan. Consequently, during the taking of potentials in Kansas on properties where coolers are installed, it is frequently a practice to have the fan of the cooler driven by a separate engine employed for this purpose. Ordinarily, under the usual operating conditions, temperature is controlled by a valve in the line or bypass, which is frequently operated by a thermostat.

In considering the merits of the pusher and suction types of fans, it is found that each type has its proponents. For the pusher type it is claimed there are two advantages to be had through its use. The first is that it is adapted for installation inside the building in such a manner that air may be blown from the building through the radiator and to the outside through an opening, which may be wholly or partially closed in the winter time; in this way it is possible to keep the engine room cooler. The second advantage claimed for the pusher type is that the radiator is kept cleaner when air from the building is blown out through it than when air is pulled in through the radiator from the outside. Advocates for the suction type of fan claim that a higher efficiency justifies foregoing these advantages. With either type of fan, the installation of the cooler may be placed in the wall of the building or outside.

Radiators are made either with horizontal or vertical tubes of a round or flat type. For the horizontal tube it is claimed the circulating water remains longer in the radiator since it moves more slowly; for the vertical tube it is claimed there is an advantage in having sediment drop to the bottom instead of settling in the tube. One manufacturer maintains that in buying a cooler it is well to follow the same policy which is customary in selecting an engine when provision is made that loads shall be 70-80 per cent of the rating. In selecting a cooler it is important to have it large enough to do the job. The full advantage of the cooling unit may be missed if it be too small, or if the fan be operated at a slower rate than the speed recommended by the manufacturer. Even though the cooler may be designed to dissipate considerably more heat than is theoretically required for efficient engine operation, this excess capacity is provided to take care of overloaded conditions. Slowing down the fan below the proper speed may give disappointing results because, just as with a centrifugal pump, too low a speed brings a serious loss in efficiency.

During the past year the rapid spread of the use of cooler units has made them one of the most distinctive innovations in pumping equipment which has attracted attention during 1937. Now that it can be seen how well they are adapted to oil-field conditions it seems odd they were not developed and introduced earlier.

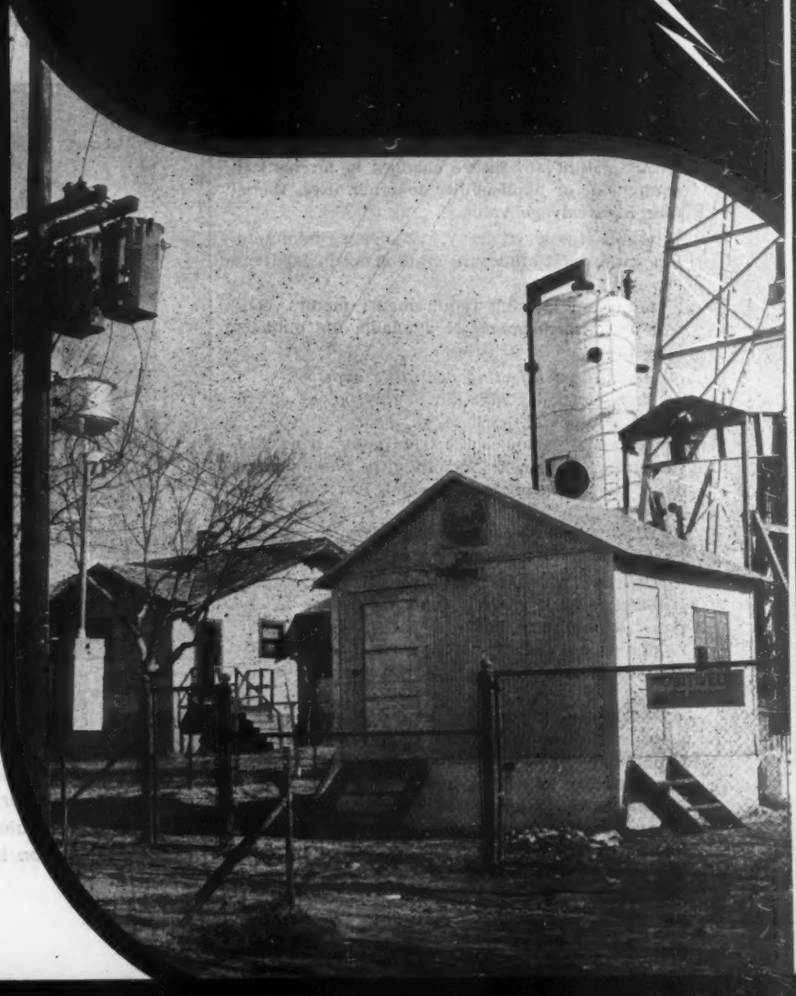
International Petroleum Exposition

The latest development in water-flooding, pumping jacks, prime movers, subsurface problems, operating practices, well servicing and steam, diesel and electric power portable and permanent pumping units will be displayed, and demonstrated at the Tenth International Petroleum Exposition, from May 14 to 21, at Tulsa, according to Hugh Stalcup, chairman of the production committee.

The latest development in the use of sucker-rods and pull-rods, a far cry from the wooden rods used in the shallow wells of the old days, will be featured.

Other production equipment shown will include: Pumping jacks, hold-ups, hold-downs, knock-off posts, pull-rods, back-crank equipment, power-driven reciprocating pumps used in water-flooding and many other types equipment necessary to the production division of the petroleum industry.

The new Hall of Science, under the direction of Dr. Gustav Egloff, will contain working models showing the process of water-flooding and will have many other models, both working and static, maps and dioramas of interest to the production men.



Application of Oil-Well

By M. A. HYDE
Westinghouse Electric & Manufacturing Co.

Fig. 1—Modern pumping unit installation in Kansas using electric drive. Equipment is outdoor type requiring no housing. Motor mounts directly on pumping-unit base, with V-belt drive to pumping gear

There is at present a noticeable trend toward electric drive for oil-well pumping, indicating an increasing acceptance of the overall advantage of this form of power. The true economic picture includes of course the fixed charges on the investment in the complete installation, covering interest, depreciation, insurance, and taxes; and it likewise includes the operating costs for energy, labor and supplies. In addition certain collateral factors are definitely a part of the picture. In many cases where a decision against electrification might have resulted from consideration only of the comparative purchase price of equipment and the comparative cost of fuel from the field versus electric energy, the actual choice has been electric drive due to evaluation of other advantages inherent in motorization. A number of these inherent advantages may be listed as follows:

Advantages affecting capital costs and therefore fixed charges:

Long life, consequently low depreciation.

Adaptability to future changes in mechanical equipment, or applicability to other uses, therefore high salvage value.

Compactness, thereby requiring minimum foundation and otherwise minimizing installation expense.

Minimum housing requirement; motors, control and transformers all available for outdoor mounting.

Advantages affecting operating expense:

High efficiency maintained throughout entire life of equipment.

Low Maintenance—Electric motor has only three moving elements including the two oil rings of a sleeve-bearing motor, and has only two bearings.

Experienced operators unnecessary.

Adaptable to remote or automatic control.

Collateral Advantages:

Safety—With modern control operator is exposed to minimum hazards.

Convenience—Push-button control is easily operated and may be placed in most accessible location.

Reliability—A result of simplicity. Also equipment is relatively unaffected by seasonal changes, is not subject to freezing cooling system or starting difficulty in cold weather.

Smooth Operation—Steady torque of motor as compared to pulsating torque of engine means lower stresses in driven mechanical equipment. In many cases this has reflected in lower maintenance and longer life.

Neatness—Minimum of parts makes for trim appearance, an influence toward better general maintenance around the well.

Quietness—Electric motor operates with minimum noise, sometimes a factor in locations near dwellings or public buildings.

Electricity available for lighting around the rig.

Ease of testing, making available accurate information on the well load and power demand.

Accurate power-cost records, available by individual metering.

For the fullest realization of these advantages it is necessary that the electrical equipment be intelligently selected as to rating, electrical characteristics and mechanical construction, also that it be applied with due regard for anticipated future operating conditions, and that the various parts of the system (motors, control, and distribution) be coordinated so as to function properly together in the complete installation.

Motor Selection

Horsepower—There are many variable conditions affecting the load on a well pumping unit, such as oil/gas ratio, percentage water produced, varying depth of liquid level, changes in performance of the pump and fluid friction with changes in speed, variations in counter-balancing, and change in inertia effect with change in pumping speed. Therefore, it is necessary, when estimating the motor load to allow for the various factors the most pessimistic values that are expected to be encountered. Further it is considered normal and conservative practice to apply motors to loads so estimated at about 75 to 80 per cent of the motor rating. For convenience this factor will be referred to as an "application factor." The results of such estimates must obviously be considered as approximations only, and it must be expected that they will require verification by actual test on the unit in service.

Fig. 2—A typical control for pumping unit; comprising combination motor disconnect and starter with start-stop push-button, 440-volt service plug receptacle, watthour meter and surge protector, and lighting circuit fuses with coverplate. A separate weather-proof push-button is mounted at the rig

If the well is already equipped for pumping and driven by mechanical power, a test may be run under typical conditions using a polished-rod dynamometer to obtain the horsepower transmitted through the rod. This polished-rod horsepower should be divided by the combined efficiency of pumping unit, pumping gear and transmission from gear to motor, in order to arrive at the motor output. This procedure combined with the use of an application factor of .75 means that the polished-rod horsepower should be multiplied by about 2 to arrive at the rating of the motor to be applied.

If the well is already equipped for pumping and driven by an electric motor, a test of average kilowatts input may be taken. The proper motor rating should then be about 1.6 times the average kilowatts input (based on an average motor efficiency of .90 and an application factor .75).

If the pump is not yet in operation but certain data applying to same are known, an approximate motor rating can be estimated from the following formula:

$$\text{Horsepower rating} = \frac{D^2SLN}{600{,}000}$$

Where D = diameter of pump barrel in inches.
S = stroke length in inches.
L = depth to oil surface in feet, allowing for ultimate fluid level.
N = strokes per minute.

This formula is based on an overall mechanical and hydraulic efficiency of about 70 per cent and the use of an application factor of .75.

Power Supply Characteristics—The majority of motors driving pumping units range from 2 to 40 hp. The power supply to this range of ratings is generally handled most economically at 440 volts three phase, which has become practically standard as the utilization voltage in the oil fields.

Motor Type—While wound-rotor induction motors have been used extensively in the past for the combined duty of pumping and well-servicing, present practice on installation of new equipment is almost entirely to use the squirrel-cage motor in combination with the self-contained pumping unit and to handle well-servicing operations with portable equipment specifically for that purpose. The squirrel-cage motor has the ad-

Electric Drive to Pumping Units

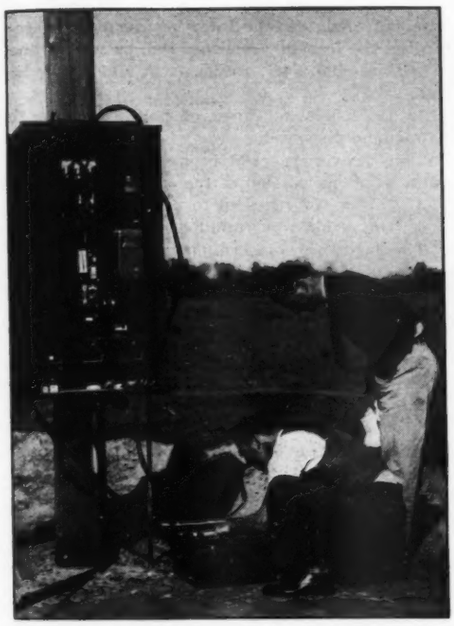


Fig. 5—Engineers taking an electrical test on the operation of a Kansas pumping rig, using the convenient "industrial analyzer"

vantages of: (1) lowest first cost; (2) high efficiency; (3) mechanical simplicity and ruggedness; (4) adaptable to weatherproof construction requiring no housing; (5) requires simplest control.

Squirrel-Cage Motors

There has been considerable interest recently in the use of squirrel-cage motors of the high-slip type. These are mechanically the same as the conventional squirrel-cage motor but are designed with a drooping speed-torque characteristic; that is, when loaded they slow down to a greater extent than does the normal-slip type. For instance, the normal-slip motor carries full load at only about three per cent below its no-load speed, while a high-slip motor may slow down when carrying its rated load to say about 10 per cent below its no-load speed, and the slowing down is proportionately greater at higher loads. Under the recurring peak loads incident to pumping unit operation, the high-slip motor is able to slow down and let the inertia of the moving parts take a portion of the peak, thereby reducing the peak electrical load on the power system. Tests have shown reductions as much as 40 per cent in peak current demand. Also the starting current of the high-slip motor is lower and the starting torque higher. The reduction in peak current and starting current is particularly important on systems of limited capacity.

Power distribution systems in oil fields are necessarily comparatively extended, and the effects of high currents on voltage drop must be kept within limits which will prevent interruption of other units on the same circuits. Also in case power is supplied by small-capacity generating plants, the current peaks incident to motor starting and peaks resulting from the occasional operation of a number of wells "in step" must be kept within values that will permit satisfactory voltage to be maintained.

These factors have in many cases justified the installation of high-slip motors even at a cost differential of 10 to 15 per cent above the general-purpose type.

Mechanical Construction—Splash-proof motor construction and weatherproof control housings permit open location of the electrical equipment, minimizing installation expense. The use of this form of equipment is now practically standard practice.

Control—The control equipment should provide the functions of: (1) Disconnecting motor and starter from power supply; (2) starting and stopping motor; (3) overload protection; (4) housing accessory equipment, such as time clock, watthour meter, and outlet for portable light plug.

The prevalent practice of starting these motors on full voltage leads to a very simple controller, consisting merely of a magnetic contactor operated by a push-button, and a thermal overload relay to open the contactor in case of injurious overload. This controller may be combined in one enclosure with the manually-operated disconnect switch, the door of the enclosure being then interlocked to prevent opening except when the disconnect switch is in the open position. The push-button for operation of the magnetic contac-

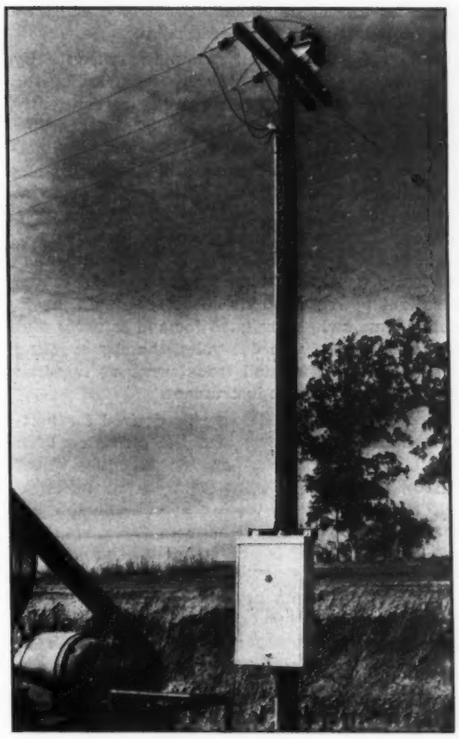


Fig. 3—Pumping motors operate most of the time at less than full load, which decreases the power factor of the power supply system thereby reducing its effective capacity. Capacitors are frequently applied to correct this condition and promote efficient operation of the power supply and distribution system. Here is shown a pole-mounted capacitor connected to the feeder at the location of the pump-motor installation

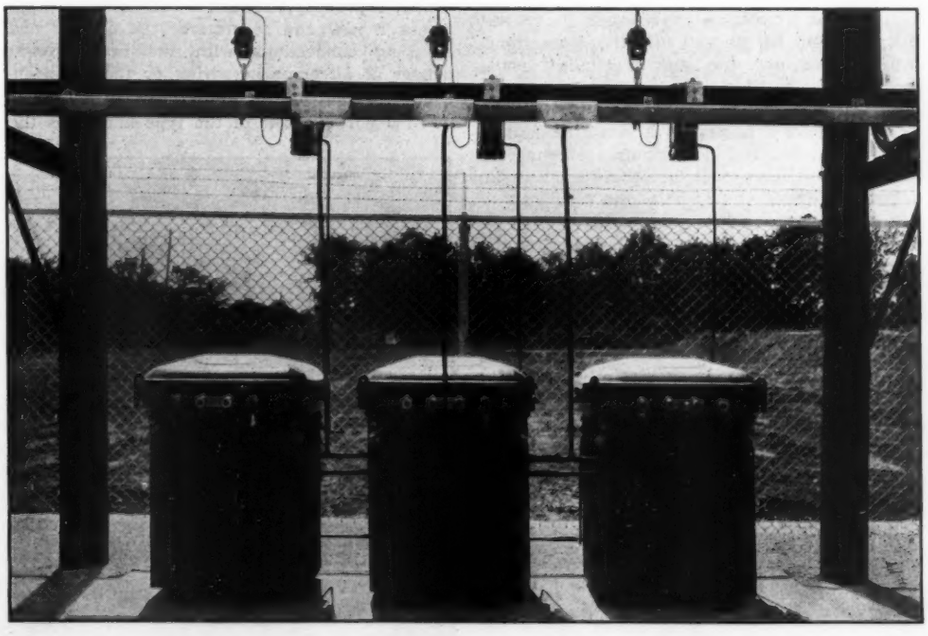


Fig. 4—Three 100 KVA surge-proof transformers supplying a group of pumping motors from 4,100-volt feeder. Three primary fuse cutouts and minimum installation material complete this simple substation for distributing power to the pumping units

tor is usually of the weatherproof type and may be located at any convenient point.

Control of the well pumping schedule by time switch is frequently desirable, affording the possibility of pumping the well intermittently without requiring the presence of the operator to start and stop. This provides for approximating the most efficient volume of settled production; that is, withdrawal of oil at the rate at which it flows into the well from the formation. Time switch control may also be used conveniently to stagger the loads of a number of intermittently operated wells, so as to minimize the resultant power demand. There is recently available a time switch designed for and in successful operation directly on 440 volts, thereby avoiding the necessity of a small transformer as required for the usual 110-volt instrument.

An outlet receptacle may be desired for portable lighting, involving also the provision of a small dry-type transformer for stepping down from 440 to the 110 volts required for the lighting circuit. Another feature found valuable by some operators is a watthour meter, permitting an accurate record of the power consumption of the individual well for cost study purposes. Such accessories are commonly mounted along with the controller proper, in a single sheet steel cabinet of weatherproof construction shown in Figure 2.

A recent development that promises to be very useful in metering the power consumption of individual units, as well as in facilitating the conduct of special tests, is the detachable watthour meter and socket. This device consists of a standardized socket for either protected or outdoor mounting, which may be installed by simply screwing into the conduit. The socket provides suitable jaws for receiving the prongs on the base of the detachable watthour meter. The watthour meter is simply plugged into this socket as one would plug a floor lamp into an electrical outlet in the home, after which a sealing ring placed around the edge where the meter joins the socket makes the installation permanent and weatherproof. Although introduced only four years ago there are already more than 3,000,000 watthour-meter sockets in use today.

A logical extension of this idea is a complete line of socket type instruments. These are now available, including voltmeters, ammeters, watthour meters, circular chart recorders, and a test jack, that can be plugged into the same standardized socket, once the latter is installed. In the past, in order to use conventional instruments it has been necessary to run temporary wiring to the motor starter, involving a certain amount of bother each time the instruments are connected for use. Now however when the socket is installed permanently as a part of the wiring either continuous power consumption records may be taken by plugging in the watthour meter, or the socket can be sealed off by a coverplate and sealing ring. Then when it is desired to secure test data on the particular well the coverplate is simply removed and the required instrument or test jack can be plugged in. This consumes minimum time, entails no stoppage of production, insures correct connections, and provides maximum safety.

The socket is a low-cost item, about $2 for a 5-jaw 3-phase 3-wire with automatic circuit-closing device. Since it fits into a conduit without special mounting it is very inexpensive to install. In fact the cost of socket and installation will be ordinarily repaid the first time a test is made.

Where the watthour meter is a permanent part of the installation, a combination test jack and watthour-meter socket, or a second socket for test instruments, permits the watthour meter to be retained in the circuit while the test is being made. (See Figure 8.)

A device extremely useful in the testing of motor loads is an assembly of several instruments together with the necessary instrument transformers and permanent interconnections, all into a single easily portable unit known as the "industrial analyzer." Portable testing equipment is frequently found to be incomplete or uncoordinated, or fragmentary, having been collected without any particular planning. Equipment that is complete usually consists of a half-dozen or more separate portable instruments and instrument transformers, a bulky and troublesome collection to transport around an oil field. Each job means a new and separate set-up, making and checking connections with the ever present danger of an error in wiring or the inconvenience of not having the proper instrument.

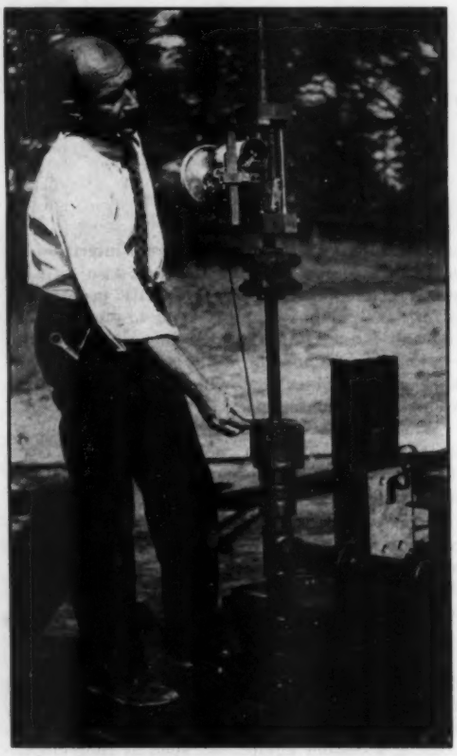


Fig. 6—Making the polish-rod talk by taking a load chart with pumping unit in operation

New portable sets of the type known as the "industrial analyzer" overcome these conditions. In reality the unit is a miniature portable switchboard panel in a carrying case complete with all necessary switching equipment, transformers, and resistors. Multirange ammeter, voltmeter, wattmeter, and power factor meter cover all ordinary circuit conditions encountered in the oil fields. (See Figure 5.)

There are occasions when it is desirable to make tests on the output side of the surface equipment, either in conjunction with tests on the motor on the input side, or independently. For this work polished-rod dynamometers are available, one form of which is shown in Figure 6.

This particular device is a self-contained mechanically operated unit for measuring and recording the load in a polished-rod, as well as the speed throughout the stroke, from which may be obtained:

1. The complete range of polished-rod loads throughout the stroke.
2. The average velocity and acceleration of the rod for any portion of the stroke.
3. The power required to pump the well.
4. The strokes per minute.

The instrument is ordinarily clamped to the polished-rod, measuring the elongation of the rod as the tension varies throughout the stroke. It also may be mounted above the cross-arm when it operates in compression, supporting the rod string and measuring the load by recording the compression produced in four calibrated columns forming a part of the instrument when applied in this manner. The load chart is made by a deflecting stylus on a drum supporting a card of specially prepared paper, this action being similar to that of a steam engine indicator. A typical chart is shown in Figure 7.

Much valuable information has been gained from the intelligent use of testing facilities. One operating company has found it profitable to assign a man exclusively to taking polish-rod load tests on all its wells in continuous rotation so that records may be had of each well at regular periods and adjustments made as operating conditions change.

Within the past few months one equipment manufacturer made dynamometer tests on upwards of 100 wells in Kansas, Oklahoma, and Texas as a study of actual pumping conditions in relation to equipment loading, and found that in many instances existing peak loads could be brought within the capacity range of the equipment by suitable counterbalance adjustments.

It is generally recognized that the proper ad-

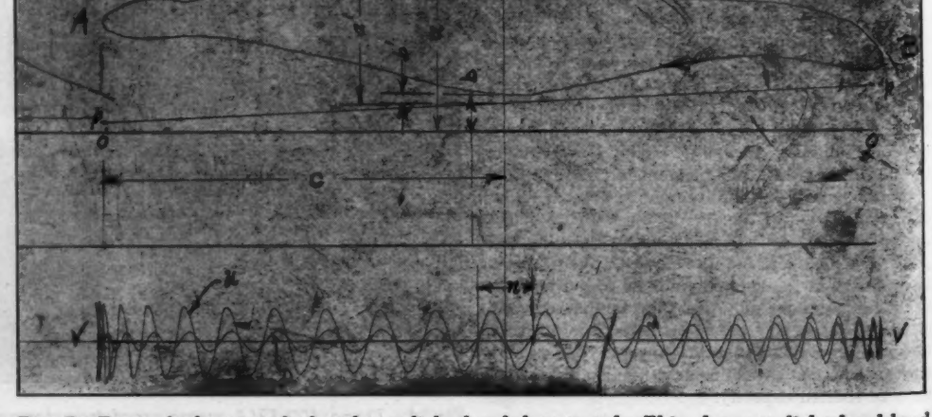


Fig. 7—Typical chart made by the polished-rod dynagraph. This shows polished-rod load variation through a complete pumping stroke including peak load, horsepower (from enclosed area), also rod speeds and accelerations (from timing wave)

justment of counterbalance on a pumping unit is important in minimizing the peak stresses on the pumping gear and the peak load on the prime mover. Intelligent counterbalancing pays dividends in reduced equipment failures and lower maintenance expense, thereby placing a premium on accurate knowledge of individual rig performance which only testing can develop with certainty.

Furthermore, the properly counterbalanced well is pumped with minimum consumption of electric energy and minimum motor heating. Power loss in an electric motor takes the form of heat. A considerable part of the loss in motor, known as copper loss, is due to resistance to the passage of current through its windings. This loss is not a strict function of the average current but depends rather upon a value known as the root-mean-square current, obtained by taking the square root of the average of instantaneous current squared values at equal time intervals throughout a complete load cycle. In the case of a perfectly uniform, non-pulsating load, this root-mean-square (RMS) current is equal to the average current, but if the load is one involving recurrent peaks and valleys the high values tend to increase the RMS current more than the low values tend to reduce it, hence the resultant RMS current becomes greater than the average current and the heating effect is greater.

A simple watthour meter observation saved one operator a possible motor burnout on a load that measured a net electrical input within the motor rating. Here the motor was driving a unit equipped with take-off for pumping a second well, and the counterbalance arranged for balancing the two wells operating together. However, the one well had been disconnected leaving the rig badly unbalanced resulting in abnormal peak loads. The unbalance was so bad that during part of the cycle the rig overhauled the motor causing it to regenerate or feed power back into the line. The watthour meter reversed its direction of rotation each time this occurred, thereby plainly indicating regeneration. Although the meter subtracted the regenerated energy in arriving at its registered total, the heating effect of the current occurring during regeneration was of course additive, consequently a higher motor temperature was produced than corresponded to the average load as obtained from the meter register. The second well was later connected to the rig and the motor when pulling both wells in a balanced setup operated 28° C. cooler.

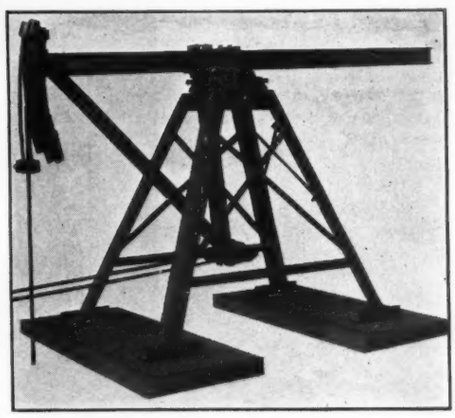
The importance of adequate facilities for studying the operation of pumping wells can hardly be over-emphasized. Not only does such study increase the available general knowledge of pumping unit behavior, but it has demonstrated its worth repeatedly in indicating possible improvements in pumping efficiency, showing up causes of specific troubles and pointing to corrections whereby maintenance has been reduced and equipment life prolonged on the mechanical as well as the electrical parts of the installation.

Fig. 8—It can be done just as conveniently in the oil field: Socket-type watthour meter and test jack provide complete test on a lathe without disturbing production. Measurements include integrated energy consumption, average load, and instantaneous values of power input, current, voltage and power factor

Free Beam Type Pumping Jack With Derrick Type Frame

For the purpose of improving jack installation and the servicing conditions at small wells, a new underpull jack has been developed with a special type of construction which has several unusual features, the most conspicuous one being what is known as the "free beam." This is a product of the Union Machine Company of Bartlesville, Okla., which manufactures a line of friction clutch pulleys, pumping powers, complete pumping plants, roller boxes, knock-off blocks, surface rod specialties, and Durnell counter balanced pumping beams.

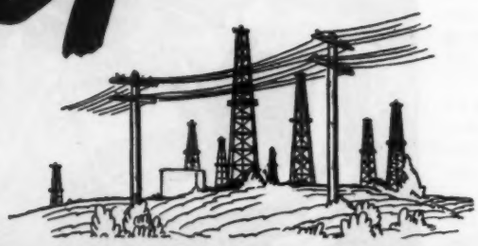
This recently developed free beam type jack has been designed to provide for mounting the down bar in front of the bearings thus permitting the beam to swing clear of the well when work is being done to service it. The frame is of electrically welded, all steel, derrick style construction providing bracing in every direction designed to eliminate the need of side braces and tie rods. Bearings are mounted on a convex setting so that the journal is not cramped when adjustments are made.

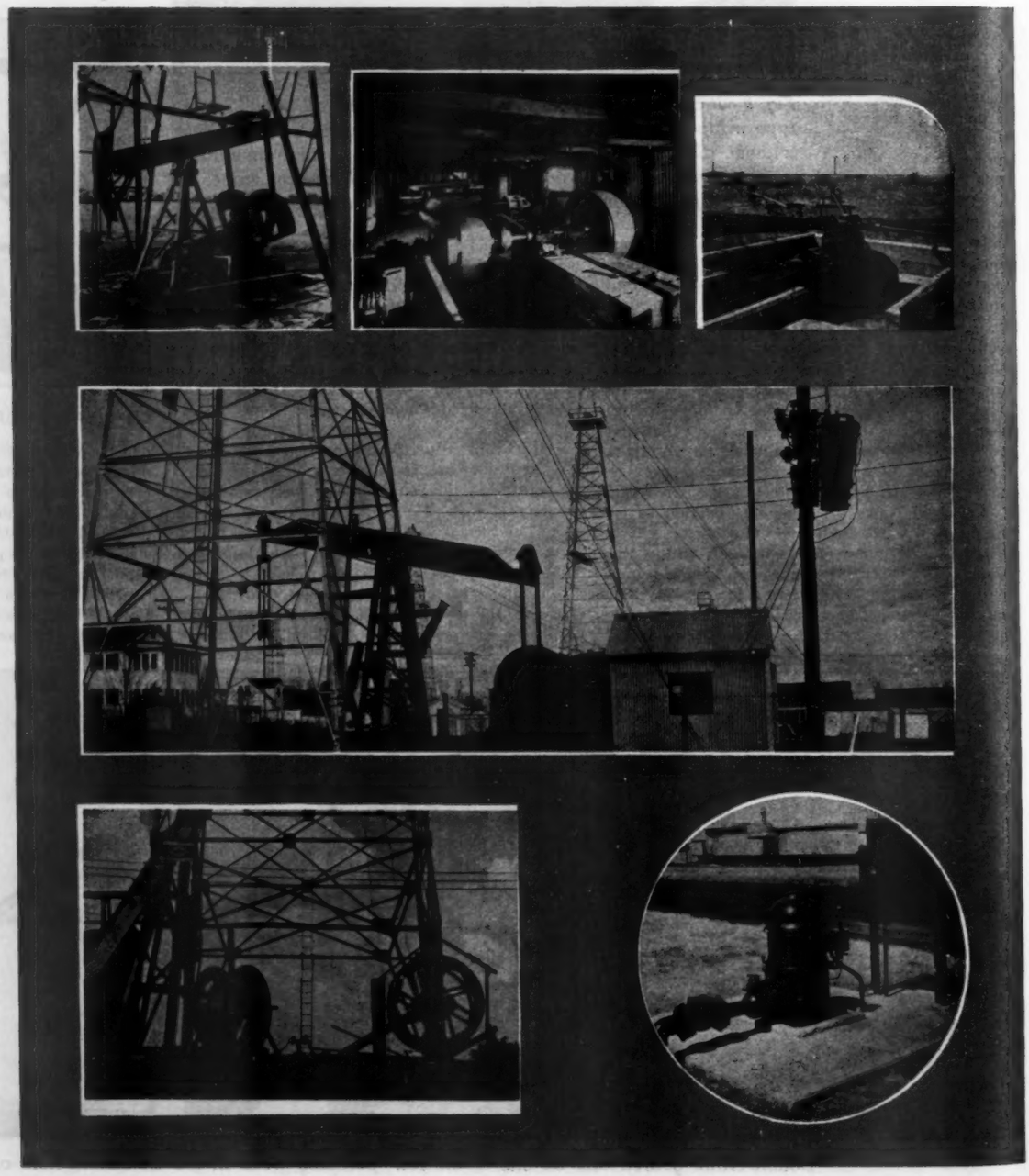


Free beam pumping jack with derrick frame

Double-crank geared unit on one of the few pumping wells in the Goldsmith field of Texas

Purchased Electric Power





Here are several of the many ways which operators are using Purchased Electric Power to increase production efficiency and at the same time lower costs. Refiners, drillers and pipe line operators, too, find electrically powered equipment profitable.

Performance of Reda Pumps in Oklahoma City

By W. H. STUEVE
Engineer, Oklahoma Gas & Electric Co.

The Reda submerged electric motor-driven centrifugal pump has proved itself reliable, efficient, sturdy, and unusually capable of producing large volumes of fluid from great depths at a reasonable cost of operation. Particular emphasis has been placed on handling large volumes of fluid in its design and operation. No other known producing equipment on the market today can lay claim to all these qualities, when comparisons are drawn with other types of pumping units regarding net fluid delivered to the surface of the ground, after all factors are considered.

Fortunately, sufficient data were obtained from 15 installations covering a period of six months' operation, handling a total of 4,561,726 bbls. of fluid from depths of 4,500 feet to 6,200 feet, from which a great amount of data could be gleaned.

This field data is assembled in Table 1, and tabulated with respect to capacity of the pumps, as follows:

OKLAHOMA FIELD DATA

Wells—	Number studied	Capacity in bbls./hr.	Considered as
A to F	6	90 to 100	Large volume
G to J	4	70 to 80	Medium volume
K to N	4	55 to 65	Small volume
O	1	40 to 45	Smaller volume

In reviewing Table 1 it is noted that the 15 pumping units operated a total of 59,704 hours out of a total possible 65,880 hours, representing an operating factor of 91 per cent, or an average loss of only 68 hours per well per month. Further, it is noted that 11 wells out of the 15 studied operated in excess of 4,000 hours during six months' period out of a possible 4,392 hours for March 21 to September 20. This record of "down time" is almost unbelievable, when considered from a standpoint of the actual design, involving calculations of high speed, small air-gap in the motor, bearing surfaces limited, and the small diameters of the overall unit allowable to permit its installation in relatively small casings.

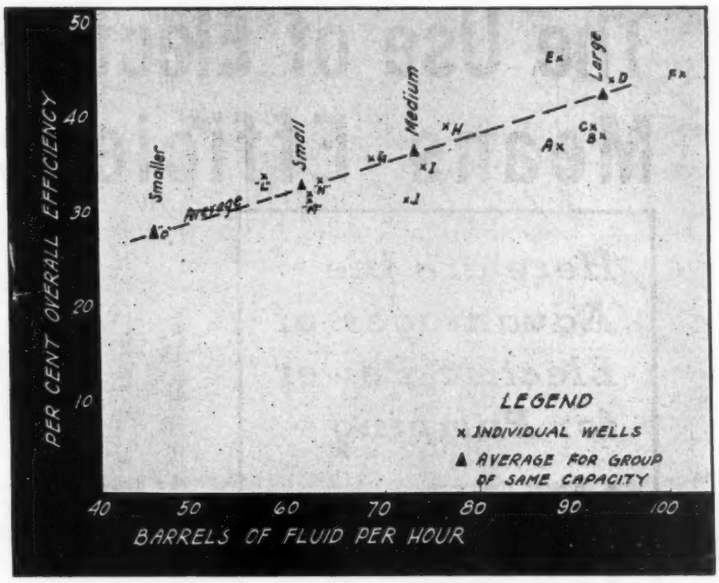


Fig. 1—Classification of 15 Reda pumps for size based upon efficiencies attained when operating in the Oklahoma City area

Sand-Hauling Ability

Superficial studies made in the past of "down-time" records of other forms of pumping equipment indicate an average considerably greater than the "down time" actually occasioned by Reda pumping units. It is also logical to assume that the Reda pump unit would also handle sand in greater quantities than other forms of pumping equipment. However, the 15 pumps covered in this study are pumping in an area in the Oklahoma City oil field where the sand problem is not so great as it is in the zone adjacent to the State Capitol Building. The slight variation in kilowatt hours consumed per barrel of fluid lifted can be accounted for in the mean depth through which the pumps are operating, but the data do not disclose when the pump was lowered to its final depth.

The highest or better efficiencies are disclosed to be obtained when the pump units are operated at their most efficient design head. This study reveals the fact that the data in Table 1 must be broken down further into the four sizes of pumps mentioned previously, and further that the computed efficiencies and head-capacity calculations obey all the laws expected of a normal centrifugal pump.

Thus, the six wells listed "A" to "F" as "Large Volume" pumps are, no doubt, operated with the same type of pump containing the same number of stages in each well; and well "E," pumping an average of about 90 bbls. of fluid per hour from a mean depth of 5,876 feet, has the highest overall efficiency of the six wells, which may be accounted for in the specific gravity of the total fluid being lower than with the other five wells, and also on account of being operated at the proper head design point.

This conclusion, with respect to depth, holds true when the four wells "G" to "J," "Medium Volume" wells, are studied, in that well "H" has the highest efficiency when pumping from the greatest mean depth of the four wells at 5,687 feet,

TABLE 1—REDA PUMP OPERATION DATA FOR 15 WELLS IN THE OKLAHOMA CITY FIELD COVERING THE PERIOD MARCH 21, 1937, TO SEPTEMBER 20, 1937, INCLUSIVE.

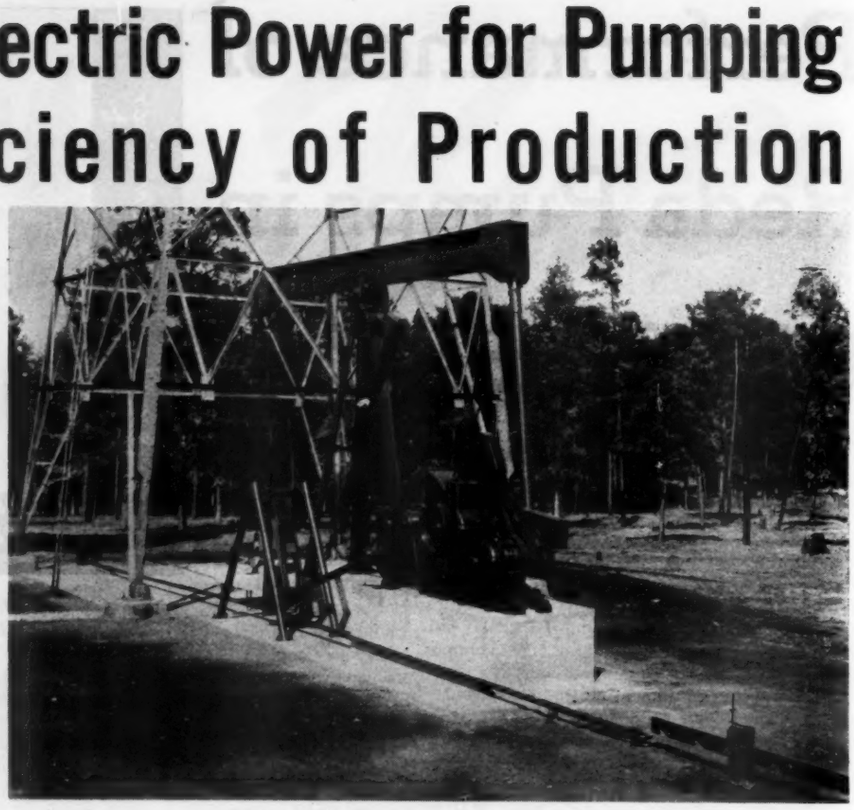
Well—	Depth in feet at which the pump suction is set: Start	Final	Mean	Actual hours operated	Barrels produced: Sp. gr. .85 oil	Sp. gr. 1.14 water	Total fluid	Specific gravity of fluid	Bbls. of fluid per hour	Total energy consumed, K.W. hrs.	K.W.H. per bbls. of fluid	Overall efficiency power input to tank	Average power demand, K.W.
Large Volume													
A	4,154	5,019	4,581	3,300	9,853	283,337	293,190	1.13	88.8	552,190	1.89	36.3	168
B	4,213	5,032	4,623	4,005	15,462	358,121	373,583	1.13	93.4	683,830	1.83	37.5	170
C	4,581	5,055	4,819	4,036	16,712	357,193	373,905	1.13	92.5	701,729	1.88	38.4	174
D	4,727	5,035	4,881	4,118	17,973	370,738	388,711	1.12	94.4	646,924	1.67	43.2	157
E	5,788	5,964	5,876	4,031	50,802	309,276	360,078	1.10	89.4	672,969	1.87	45.9	167
F	4,677	5,559	5,118	4,216	24,121	407,971	432,092	1.13	102.4	751,668	1.74	44.0	179
Total	28,140	31,664	29,898	23,706	134,923	2,086,636	2,221,559			4,009,310			
Average			4,983	3,950				1.125	93.6		1.80	41.5	169
Medium Volume													
G	5,246	5,591	5,419	4,223	29,291	264,085	293,376	1.11	69.3	663,878	2.27	35.3	157
H	5,189	6,185	5,687	4,157	25,290	293,539	318,829	1.12	76.9	693,440	2.17	38.8	167
I	5,066	5,244	5,155	3,716	16,384	260,711	277,095	1.12	74.5	616,118	2.23	34.4	166
J	4,518	5,483	5,000	4,051	17,927	277,722	295,649	1.12	72.8	710,634	2.40	30.9	175
Total	20,019	22,503	21,261	16,147	88,892	1,096,057	1,184,949			2,684,070			
Average			5,301	4,037				1.12	73.5		2.27	36.2	166
Small Volume													
K	5,402	5,782	5,592	4,200	37,902	224,669	262,571	1.10	62.5	682,827	2.61	31.2	163
L	6,202	6,191	6,197	4,206	53,555	189,119	242,674	1.08	57.6	637,861	2.63	33.5	152
M	5,470	5,751	5,610	3,389	10,909	200,779	211,688	1.12	62.2	567,132	2.68	31.1	167
N	5,760	5,760	5,760	3,851	16,724	228,127	244,851	1.12	63.6	628,828	2.56	33.0	163
Total	22,834	23,484	23,159	15,646	119,090	842,694	961,784			2,516,648			
Average			5,790	3,912				1.11	61.5		2.62	32.4	161
Smaller Volume													
O	6,157	6,159	6,158	4,205	50,996	142,438	193,434	1.06	46.0	600,216	3.12	27.7	143
Grand total	77,150	83,810	80,476	59,704	393,901	4,167,825	4,561,726			9,810,244			
Average			5,365	3,980	8.6%	91.4%	100.0%	1.116	76.8		2.15	36.8	164

The Use of Electric Power for Pumping Means Efficiency of Production

Here are the Advantages of Electric Power for Pumping

- Lower first cost
- Lower maintenance cost
- Lower fixed charges (taxes, interest, insurance, depreciation, etc.)
- Less trouble, fewer repairs, smoother operation
- Longer life for all equipment
- Smaller warehouse stock of repair parts
- Fewer accidents
- Less fire hazard
- Not affected by bad weather or shortage of water
- Not affected by sour gas or gas shortage
- Not affected by freezing in gas or water lines
- Easy to start in any weather
- Operation can be controlled automatically
- Counterbalancing more easily accomplished
- High salvage value in electric equipment — easily moved
- Pumping with electricity makes the cost of electricity for other purposes around the lease much lower
- Clean and efficient
- Accurate records more easily kept
- Less shut-down time

LOWER OVER-ALL COST, PER BARREL, OF FLUID LIFTED



East Texas Oil Companies and Independent Operators are using purchased electric power for production, principally because the rates offered are low. They know that the use of this cheap dependable electric power means production efficiency. It is the right power for automatic operation of wells on intermittent schedule in prorated fields.

The first cost of electric motor installation is far less than other forms of power. Electric equipment has a high salvage value. With purchased electric power, rod, rig and labor costs are reduced to a minimum. Electric power is the modern, dependable power. It encourages efficient operation and results in low over-all cost per barrel of fluid.

Complete Information on Request

Complete information on the cost of using electric power can be obtained on request from our oil field offices in Gladewater, Longview, Henderson, or Kilgore. Or address your inquiry direct to our general office in Shreveport, Louisiana.

SOUTHWESTERN
GAS & ELECTRIC COMPANY

which point is apparently the maximum head design point.

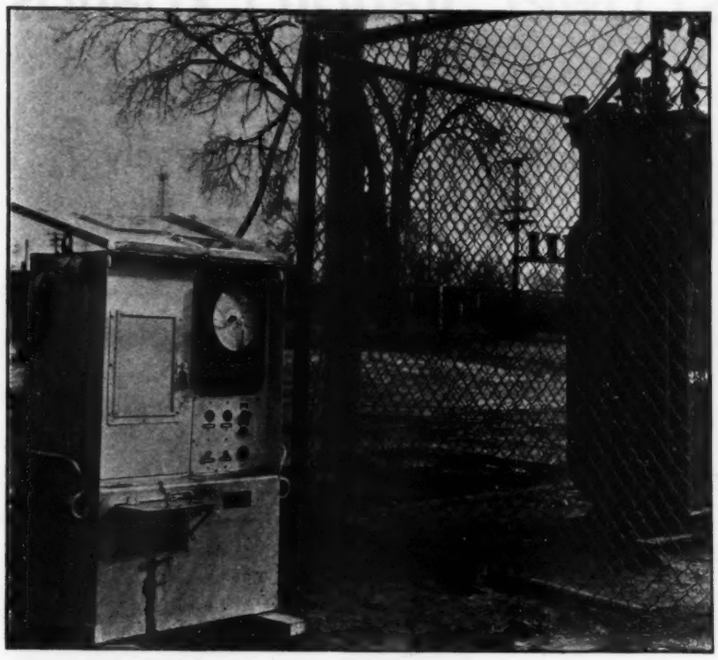
The electric motors used in the 15 wells are rated at 97½ hp. and, no doubt, all are approximately 80 per cent mechanically efficient, which would mean that the variations in average efficiency in passing from "Large Volume" pump units to "Very Small Volume" pump units are practically all due to the inherent efficiencies obtainable from centrifugal pumps in general; of course, assuming that the cable and transformer losses are approximately constant for all the 15 wells. (Actual cables are usually not cut off, but left at about 6,400 feet.)

From Table 1 it is further noted that the average electric input to the transformer and cable is 164 kilowatts, when pumping through an average depth of 5,365 feet at the rate of 76.5 bbls. per hour of fluid of 1.116 specific gravity, resulting in an overall efficiency of 36.8 per cent from the primary 4,000-volt meter to fluid delivered in the tank.

Reliable tests conducted at the factory indicate a motor efficiency of the order of 80 to 83 per cent at the maximum load design point, and that the efficiency curve is of a flat characteristic down to three-fourths full load; further, that the power factor of the motor without the power cable attached is of the order of 85 per cent at approximately full load, however, with 6,400 feet of the three-conductor cable attached, the power factor is increased approximately to 87 or 90 per cent.

The arrangement of itemized losses through the cycle of production is shown in Table 2.

Thus it is found that the pump is about 58.5 per cent efficient under average conditions, which is reasonable when consideration is given to the relative high pumping head and small volume produced with these small diameter centrifugal pumps. The losses of power in per cent of the total electrical input are shown also in Table 2. The losses in the tubing, due to friction of the fluid flowing through it, approximate 7 kilowatts of power, which can either be deducted from the pump losses and added to the useful work performed, or left as shown above as the case may be, if further itemizing of losses is desirable.



Meter-box and switches used on Reda installation

The Reda centrifugal pump is as efficient as any other known pumping unit, with the exception of the hydraulic pump. While the hydraulic pump has an efficiency of about 55 to 60 per cent, its use is limited to wells of relatively small output, and is in no sense a competitor of the Reda centrifugal pump.

The grouping of the 15 wells studied herein, based on capacity versus efficiency, is illustrated in Figure 1, which bears out the original thought in the preparation of this article: namely, that efficiencies are better as the volume is increased with depth being held approximately constant.

Further study of the data in Table 1 discloses that the oil produced amounts to only 8.6 per cent of the total fluid pumped. Thus, in terms of oil produced, the electric input energy per barrel of oil amounts to 25 kilowatt hours, or a cost of perhaps 25 cents per barrel of oil produced. Repair bills cannot be excessive or the "down time" would be greater than the record discloses. Thus, for a total cost of 40 to 50 cents per barrel of oil produced, the power bill can be paid, the repair bill paid, and the pump investment can be amortized in one year, leaving a handsome profit of more than 100 per cent to the producer at the present market price of the crude produced.

It may be said that the economic limit of the oil to water ratio is somewhere near 4 to 5 per cent of the total fluid produced being marketable oil, when pumping from depths of 5,000 feet or slightly greater.

Certain oil producers in Kansas operate Reda pumps from much shallower depths where only 1 to 2 per cent of the total fluid produced is marketable oil.

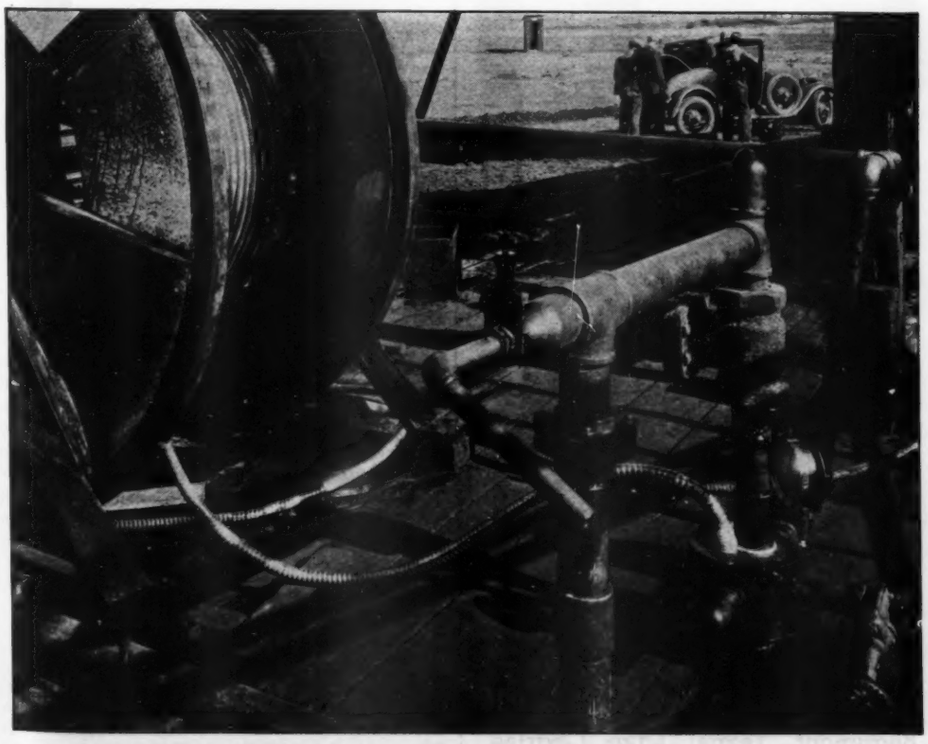
In both cases mentioned, the period of time selected for amortizing the pump equipment should be the deciding economic factor in determining the number of months or years to operate the Reda pump.

Purchased power apparently must prove economical and equitable, for out of 40 pumps in the Seminole oil field and about 200 in the Oklahoma City oil field, or a total of 240 pumps in use in Oklahoma today, only three pumps are operated with privately generated power.

The general acceptance of this type of pumping equipment by oil producers is evident by the installation made in far distant locations from Oklahoma. Several instances being installations of Reda pumps on the Gulf Coast where gas lifting costs became prohibitive and abandoned wells have been rejuvenated and now placed on a paying basis. The market for these pumps is being expanded further for adaptation to wells having small allowables, as low as 20 to 30 bbls. per day, by using one sectional part of the electric motor. These motor sizes now being manufactured are 7½ and 15 hp. for lifting at low rates of production from depths of 1,000 to 2,000 feet.

TABLE 2—LOSSES IN PUMP, MOTOR, AND CABLE AVERAGED FOR 15 WELLS SHOWN IN TABLE 1

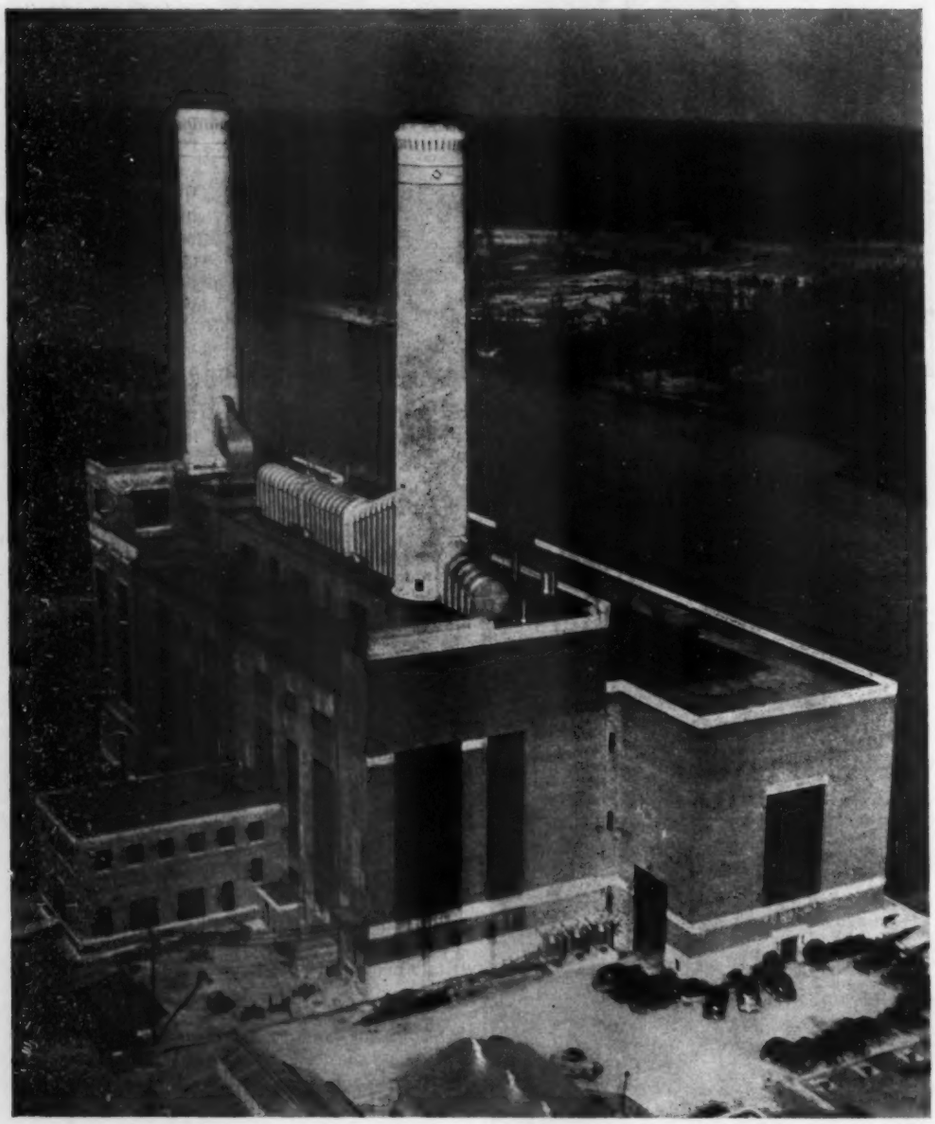
Total electric input K.W.—	K.W. losses in motor (assumed 80% eff.)	K.W. losses in pump	K.W. losses in cable 3—No. 2 wires 105 amps/phase	Fluid K.W. useful work to lift 76.5 B/H through 5,365 ft.
164	26	42	36	60
100%	15.8%	25.7	21.7%	36.8%



High-tension cable entering well to supply power to Reda pump in Oklahoma City field

Neches Power Station Expands

Oil Industry Requirements in Southeast Texas and Southwest Louisiana Largely Responsible for Installation of New Unit



For almost a year workers have been busy installing a new generating unit of 27,500 Kw. capacity at the Neches Power Station, located on the Neches river a few miles below Beaumont, Texas. The picture shows progress on the project as it nears completion.

Of the 350,000,000 kilowatt hours of electricity sold by Gulf States Utilities Company in 1937, more than 85% were used by small and large commercial and industrial customers in the Texas and Louisiana territory the company serves. Three refineries of the Sabine district are big users of this central station power and the thirty or more producing fields and many pipe line stations in this section of the Gulf Coast account for another large slice of the total. The oil industry will use an even larger percentage of the total in 1938.

Address inquiries to Gulf States Utilities Company. General offices: Beaumont, Texas; Lake Charles, Louisiana.

Fluid Seal Pump Hard Surfaced for Exacting Conditions

To meet the demands of exacting and difficult pumping conditions an improved hard cadmum surfaced fluid seal pump has been especially designed and put on the market by the Production Equipment Co., Beaumont, Tex. These pumps are manufactured in three types; key, pull, and rigid. The key and rigid types are interchangeable with the exception of the standing tube and guide point valves. The outside travelling tube is only interchangeable with the pull type, in their respective sizes and lengths.

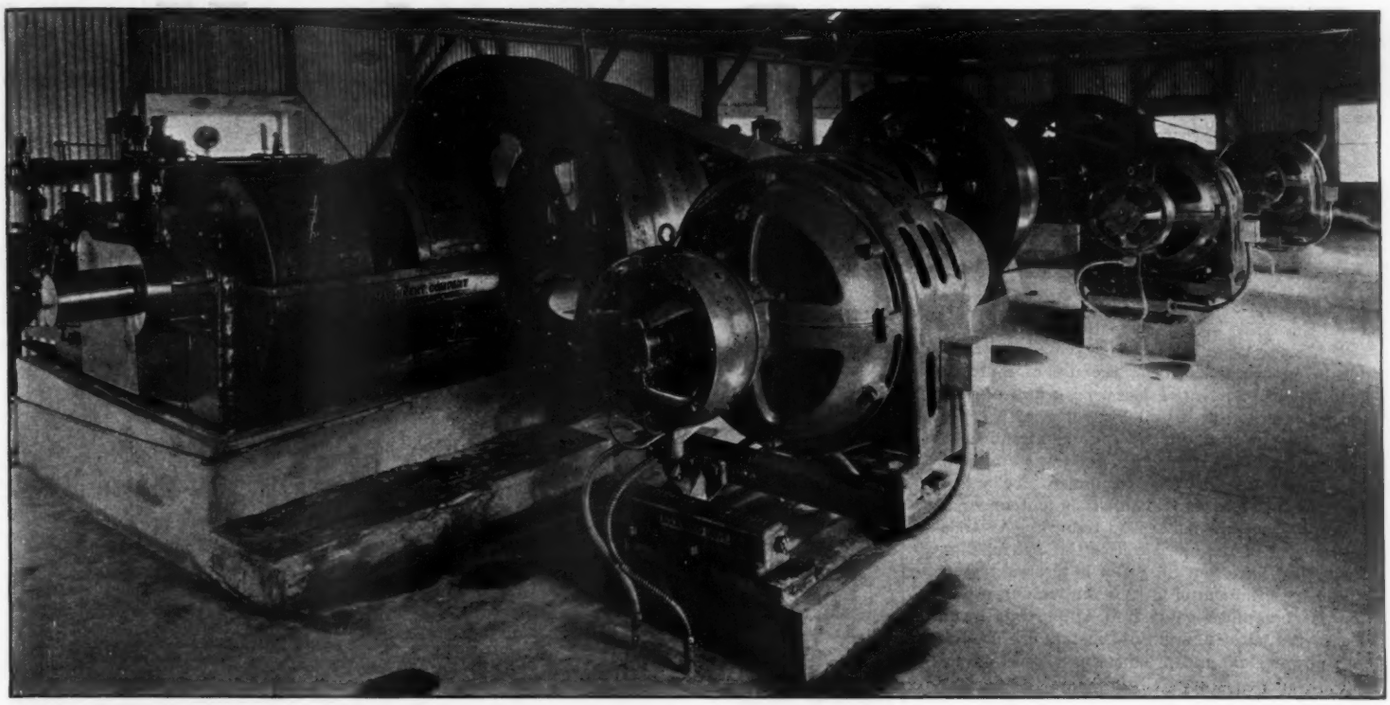
The key type pump consists of three seamless steel concentric tubes, two of which are joined at the top by a pump to sucker-rod and sub, telescoping over the third or inner fixed standing tube. Screwed to the lower end of the standing tube is a 3-cup pump hold down, except in those cases where there is a preference for a tapered seat bushing used in combination with a standing valve for the purpose of carrying the sealing cups. At the top of the travelling tubes is located the top cage for connecting pump to sucker-rod and for carrying the discharge ball and seat. The inside travelling tube carries at its lower end a guide point valve, the T head of which enters the J latch in the standing tube for latching the standing and travelling tubes when lowering and removing tubes from the well. The rigid type is similar except for the fitting used instead of T head and J latch. The pull type is run on the rods and removed by lifting the rods to the maximum stroke where a bumper nut, threaded into the top end of the standing tube, contacts a larger section of the inside travelling tube, lifting the standing tube from its seat and withdrawing the pump from the well as a single unit.

Williams' Flow Device

Williams' flow device was designed to make efficient use of the reservoir energy in flowing wells. The device is placed on a string of tubing just above the normal working fluid level in the well. Formation gas liberated from the oil in the hole accumulates in the casing under pressure, and this is admitted through the device into the tubing in a manner to cause flow by short heads at intervals of 10 to 20 seconds. It is believed that this piston-type flow will greatly extend a well's period of natural production. Designers of the device place great importance in selection of proper size tubing, proper installation depth, and proper orifice diameters in the device. These factors are determined to give the lowest flowing gas-oil ratio possible. By holding as much back pressure against the producing formation as practicable, gas is prevented from leaving the oil in the sand. Small flowing wells and wells with insufficient gas to flow normally are considered best prospects for the Williams' device.

Bow Island Gas Storage Now Totals 10,500,000,000 Feet

CALGARY, Alberta.—Repressuring operations carried on by Canadian Western Natural Gas, Light, Heat & Power Co. since August, 1930, had up to the end of 1937 resulted in the storage of approximately 10,500,000,000 feet of Turner Valley gas in the depleted Bow Island field.



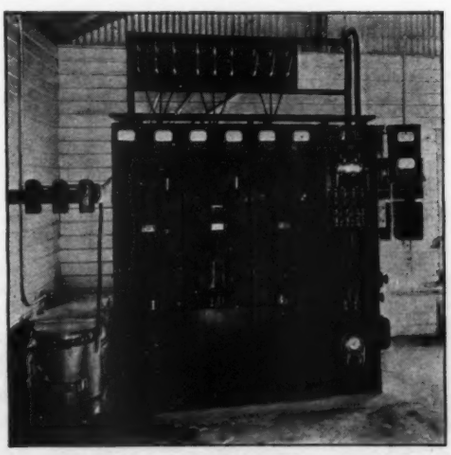
View of National Oil Co.'s new lease power-generating station on Evans lease in the Hovey Hills west of Taft, California. Power is distributed about the field at 2,400 volts

Power Plants for Lease Drilling Are Installed by National Oil

National Oil Co. of California is engaged in a program of building power-generating plants on their leases in order to develop electricity for drilling and pumping operations. Two plants are in operation, a large one having been completed recently. Engines using gas from the wells drive the generators by means of belt drives. Twenty-three wells, averaging 2,200 feet in depth, are pumped for an average monthly production of approximately 35,000 bbls. On the company's Evans lease in the Hovey Hills west of Taft, where the larger plant was built, additional drilling is to be carried on in the near future. With this in mind the plant was designed to assume the additional load necessary to operate an electric drilling rig. At the present time two of the three engine-generator sets will easily handle the entire load, so the third set provides standby service.

Unusual is the fact that well-servicing work will be accomplished with electric power, using the same motors used for pumping the wells. These are 15-35 hp. motors wound to give 15 hp. for pumping service and 35 hp. for pulling. While they are not popular on purchased-power installations because they call for a standby service charge for 35 hp. they are apparently well suited to a lease-power system.

Gas engines used in the new power plant are two-cylinder horizontal machines rated at 160 hp. at 200 r.p.m. They consume approximately 10 feet of gas per brake horsepower per hour, and it has been determined that one gallon of lubricating oil is required at 2,600 hp. hours. By means of short flat belts these engines drive 3-phase 60-cycle alternators which are rated at 125 k.v.a. with an 80 per cent power factor. The alternators are driven at 720 r.p.m. generating power at 2,400 volts. Direct-connected 125-volt exciters are used.



Switchboard in the new power plant. The three panels at the left are individual panels for the three A.C. generators. The feeder panel is at the right

Each alternator weighs 6,000 pounds and is mounted on a base chosen for its ability to maintain uniform drive-belt tension under varying power loads. In this type of mounting the only connection between the generator and its base is an off-center horizontal axle. Part of the weight of the generator is supported by the axle, while the remainder is supported by the drive belt itself. It is the weight of the generator which maintains uniform belt tension. Probably these are the heaviest generators ever mounted on this type of base.

Distribution about the field is at 2,400 volts. Transformer banks located at convenient points on the lease step this down to 460 volts for use at the wells. The transmission lines are carried on standard 30-foot poles. The longest power lines are about one-half mile long, since the plant is located in the center of a lease one mile in length. The transformers which supply lighting for the station and adjacent buildings are located inside of the power station.

The switchboard in the station has been designed for maximum flexibility of operation. A panel has been provided for each generator and there is also a feeder panel. The three generator panels are each equipped with a manually operated 200-ampere 5,000-volt oil circuit breaker, a field switch, a synchronizing plug, a voltage-transfer switch, a generator and exciter field rheostat, an A.C. ammeter, and a polyphase wattmeter. Above each generator panel is a disconnect switch. On the

(Continued on Page 200)

Hydraulic Principles Used by Kobe for Pumping

The latest development in hydraulic pumping has been the use of multi-well installations. An entire lease, or group of wells, can be operated as a unit by means of a central hydraulic power plant and individual subsurface hydraulic pumps. Since this practice permits the use of the same surface equipment for a large number of wells, the installation and operating costs per well are materially reduced. As an essential part of the operation of the central plant, the production from all wells is treated to meet pipe line specifications. The individual production is sometimes gauged in tanks, but in the case of the latest plants fluid meters are used for both power fluid and production.

Central hydraulic power plants pump clean oil which is filtered oil from the wells being produced or from other sources. This oil is pumped through stationary pipe lines and tubing to the bottom-hole pumps where it serves as a power fluid. The pump in each case is independently controlled to suit individual producing conditions. Production from all the wells, together with the returning power fluid, is conducted to central clean-up tanks where separating, treating and settling or filtering takes place. Using this principle, one California plant is being laid out to serve 19 deep wells each of which produces 100 to 250 bbls. per day. Existing central installations serve wells up to 8,300 feet in depth, with individual production ranging from a few barrels to 860 bbls. per day.

Aside from the central surface plant, the operation of the multi-well hydraulic pumping system is precisely the same as in the case of the individual-well installation. Power fluid is supplied to a group of wells by one or more triplex pumps when a central plant is used. Power fluid is supplied by individual triplex pumps for single-well installations. The single-well equipment, which is more familiar to the industry than the newer central-power system, does not provide for treating the oil produced in the way that it is done in the case of centralized operation.

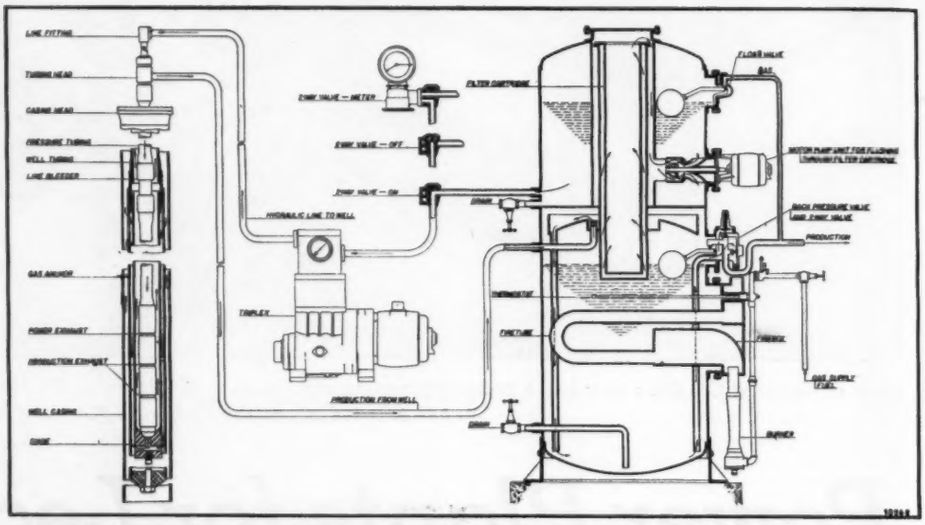
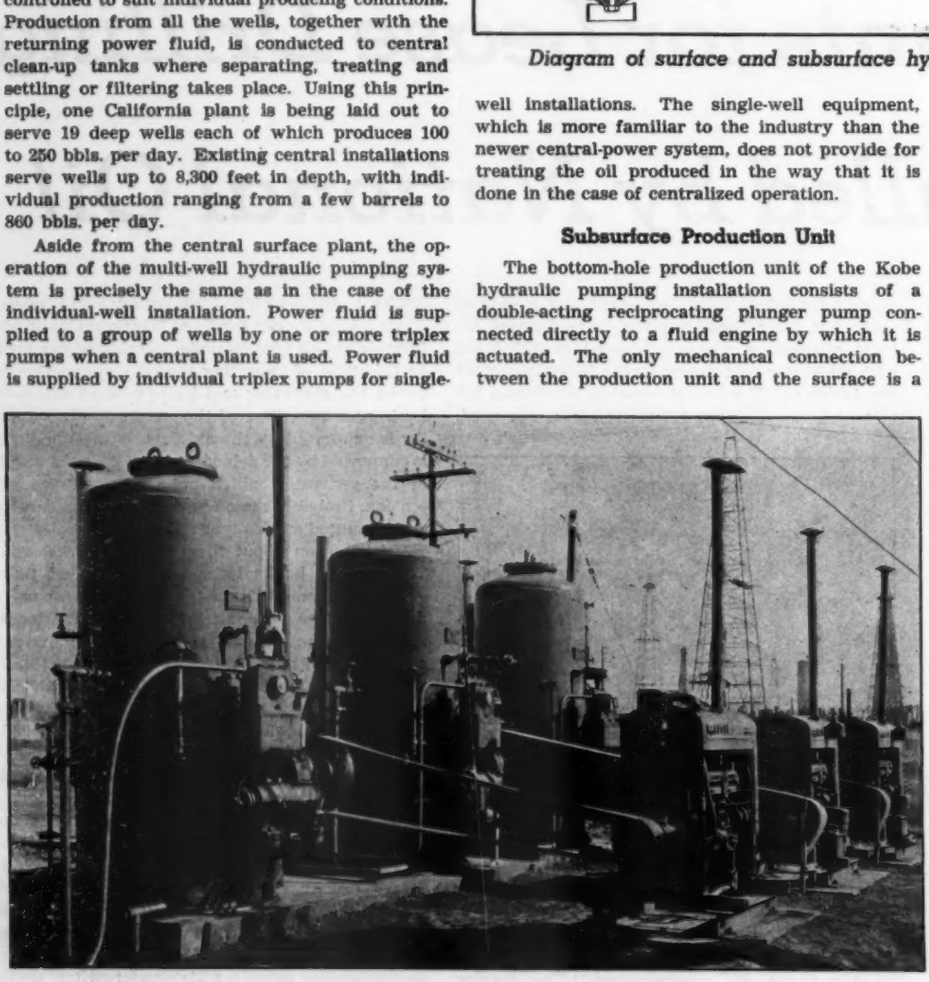


Diagram of surface and subsurface hydraulic equipment for individual wells

Subsurface Production Unit

The bottom-hole production unit of the Kobe hydraulic pumping installation consists of a double-acting reciprocating plunger pump connected directly to a fluid engine by which it is actuated. The only mechanical connection between the production unit and the surface is a string of small-diameter tubing which conducts power fluid to the engine. The hydraulic power unit at the surface, which supplies the fluid under the desired pressure, consists of a filter-separator system, when it is required, and a combined prime mover and triplex pump.

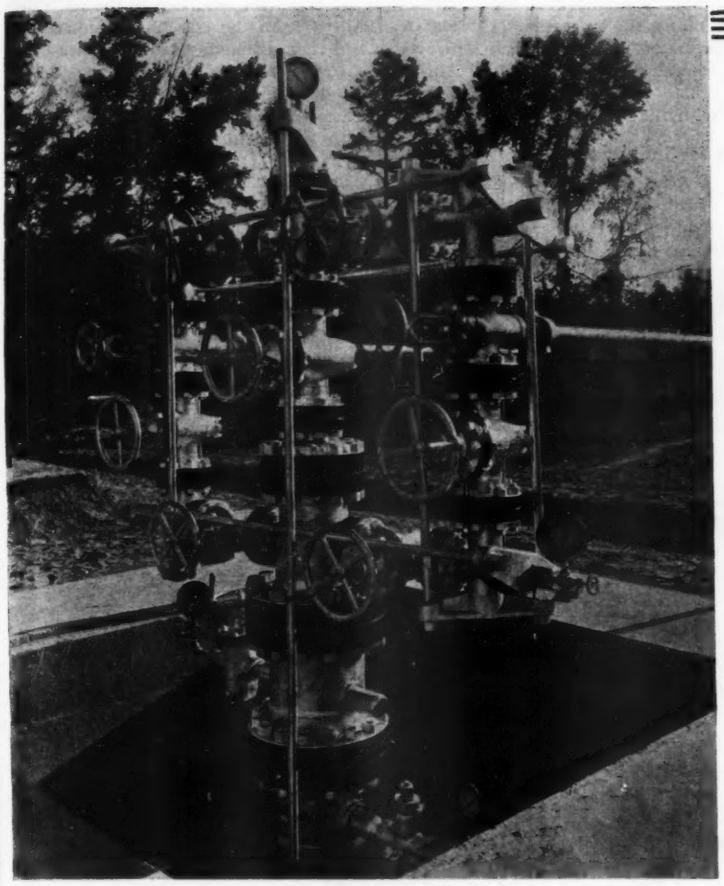
In equipping a well for the Kobe production method a full string of tubing, known as the production string, is installed with a gas anchor and seating device at its lower end. The bottom-hole engine and pump are combined in a single unit, which is inserted within the regular production string and run to the bottom on a smaller string, known as the pressure string or "macaroni" string. The unit is seated at the proper depth below fluid level in the seating shoe of the production string. After setting up the surface equipment and filling the entire system with oil, the well can be put on production. The power fluid, which is conducted downward through the pressure tubing, is discharged from the fluid engine into the annular space between the production string and the pressure string. It returns to the surface by way of this passage, mixing with the well fluid discharged from the plunger pump.



Multi-well installation for Kobe hydraulic pumps

Operation of Production Unit

Pressure fluid enters the engine through a four-way pilot-operated valve. In the position shown in the accompanying drawing, the valve permits the passage of fluid into the top of the power cylinder. The bottom end of the power cylinder is connected to the exhaust by means of the passage around the power cylinder and through the valve exhaust passage. The piston of the power cylinder has a piston-rod extension with ports that control the movement of the valve as the rod slides through the valve body. In the position cited, hydraulic pressure is applied through the ports under the valve. This will cause the valve to move to its upper position:



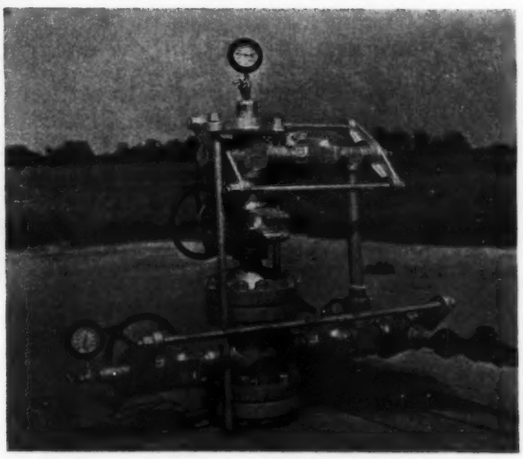
You'll find it pays to use....

BREWSTER PRODUCTION EQUIPMENT

- *for any well*
- *any pressure*
- *anywhere*

(Above)
Brewster MODEL WY-10 Well Assembly TESTED TO 10,000 lbs.

(Right)
Brewster MODEL X-6 Well Assembly TESTED TO 6,000 lbs.

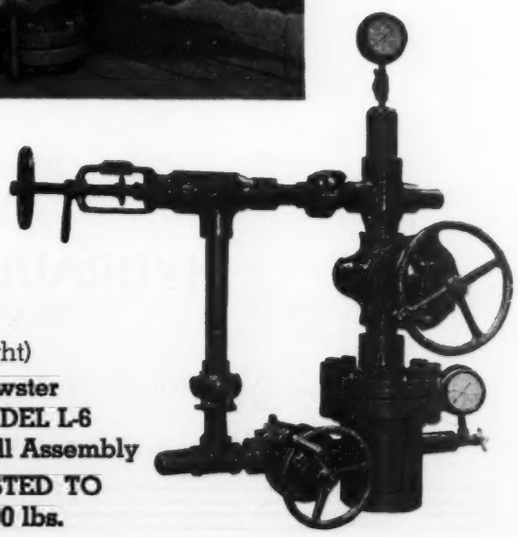


(Left)
Brewster MODEL T-6 Well Assembly TESTED TO 6,000 lbs.

BREWSTER PRODUCTION EQUIPMENT includes:

- complete, pre-tested, well assemblies
- casing heads, for any pressure, any casing combination
- tubing heads, for any assembly or hook-up, any pressure, any combination
- adjustable flow beans

Our complete line of Brewster Drilling and Production Equipment will be found illustrated and described in The New 1938 COMPOSITE CATALOG, pages 327 to 358.



(Right)
Brewster MODEL L-6 Well Assembly TESTED TO 5,000 lbs.

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When the valve reaches its upper position, pressure will be applied through the lower pressure port to the lower end of the power cylinder below the engine plunger. As the piston moves upward the oil in the top of the power cylinder will be exhausted through the valve exhaust port. When piston reaches the top of the cylinder the ports in the piston-rod extension will reverse the valve to cause the down-stroke. Actually the valve action is somewhat more complicated because of provisions made to bring about smooth operation and prevent hydraulic shock.

The engine piston is connected by piston rod to a pump plunger of equal diameter located in the production cylinder just below the power cylinder. Both ends of the pump cylinder have intake and exhaust channels fitted with ball valves. Oil enters the intake channels from the well bore by way of the passage through the pump seat and tubing shoe. Exhaust channels are connected with the annular space between the pump and production tubing. The operation of the pump is the same as that of any double-acting plunger pump; an equal volume of fluid is discharged in either direction. All of the moving surfaces are lubricated with the hydraulic fluid.

Surface Power Unit for Individual Well

When a single well is produced, production from the well, together with the returning power fluid, enters the individual surface processing tank at a point near the top of the lower compartment. At this level it flows in a thin layer over a baffle to facilitate gas separation. It collects at the rim of the baffle and passes to the bottom of the chamber through tubes to avoid mixing with the oil near the surface. Free water and sand settle out as the oil moves slowly upward. Near the middle of this lower compartment is a thermostatically controlled heating coil to partially break down the emulsion in the oil. The heat transmitted from the coil liberates part of the water and fine sediment from the emulsion. Thus by the time it reaches the top of the lower chamber, the oil has undergone all of its stages of separation except filtering, which is carried on in the upper chamber to which it is forced through

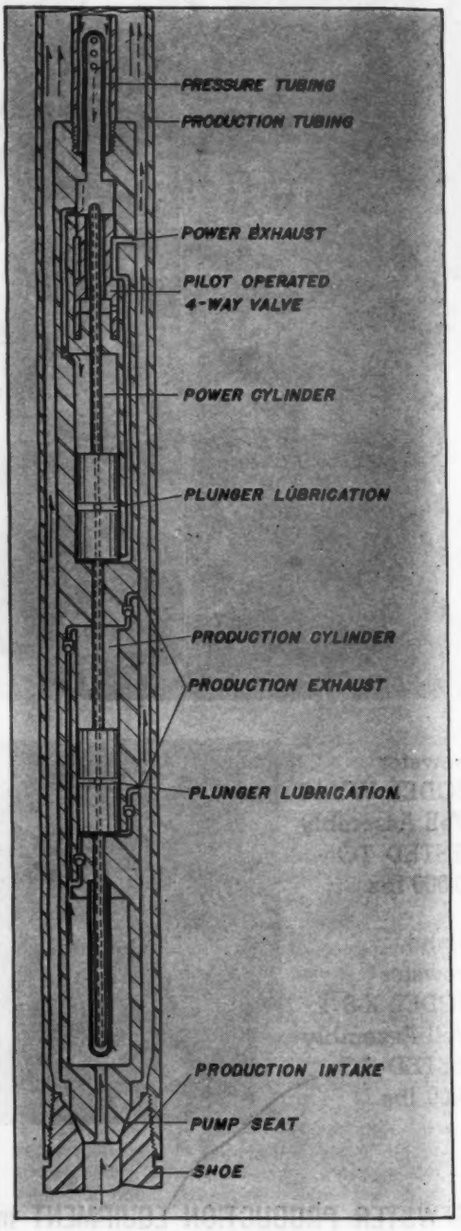
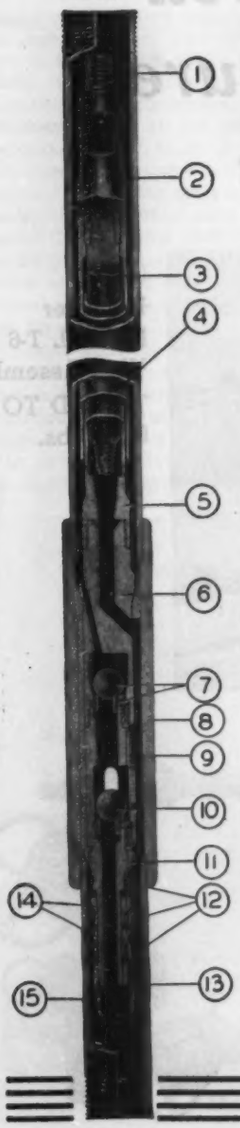


Diagram of hydraulic pump

a filter cartridge. The filter medium is made up of ceramic tubes of the required permeability. A motor-driven filter pump is used to back-wash in order to flush the deposited material from the filter and carry it back into the lower compartment where it will settle out. The motor is clock-controlled so that this washing operation is carried on at regular intervals.

Filtered oil is drawn from the filter tank by the motor-driven triplex pump which delivers it to the bottom-hole fluid engine. The triplex pump is driven either by a built-in motor or by a multi-cylinder internal combustion engine. In cases where engine drive is used, the power is transmitted by a V-belt or flexible coupling. The gear ratio of the reduction unit in the triplex can be altered to adapt it to any desired engine speed. Where engine drives are used and no electric power is available, filter flushing is controlled



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The most efficient method yet devised for lifting oil from any depth. Employs a new principle: discharges the fluid from the bottom, around tubes, on the down stroke!

No chance for sand to settle. Fluid moving on both up and down strokes. Consists of one standing and two traveling tubes, one reciprocating on the inside and one on the outside of the standing tube. Only two balls and seats. Both seats are stationary and located in the by-pass assembly. All tube assemblies 18′ long.

Two types: Insert and Rigid. Rigid type screws on bottom of tubing. Insert type permits pulling without disturbing the tubing.

Sizes are 2″, 2½″ and 3″ for handling from 250 to 750 barrels daily. Efficient at any depth.

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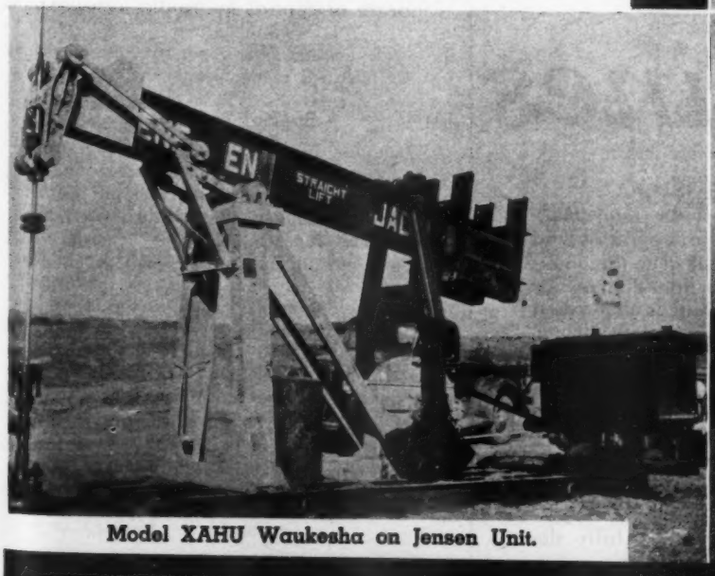
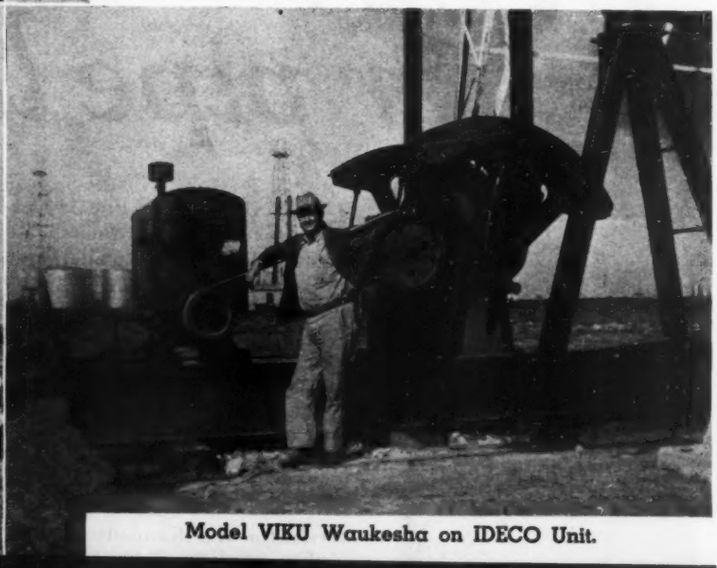
Model VIKU Waukesha on Parkersburg Unit.

Model XAHU Waukesha on Lufkin Unit.



Model XAHU Waukesha on Jensen Unit.



Model VIKU Waukesha on IDECO Unit.

MacCLATCHIE MUD PUMP VALVES:
THE WORLD'S LARGEST SELLING PUMP VALVES

A leadership founded on highest quality & greater economy

The "STREAMLINED"

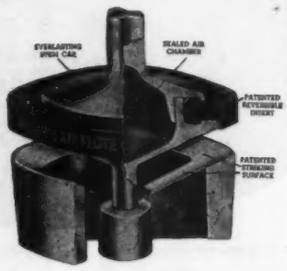
MacClatchie Streamlined Valves are recognized as the standard of the industry. Their streamlined construction gives unobstructed fluid flow entirely free of lodging areas to collect and impair the proper closing of the valve. All of the cross bar and a large part of the seat forms a streamlined striking surface. This large metal striking surface—40% greater than ordinary valves—absorbs the entire blow of the valve and assures longer life without hammered out spots to throw valve out of alignment.

The patented valve rubbers are reversible, giving double life to every rubber.

The "AIRFLOTE"

The Airflote is a fundamentally new type of valve engineered for today's deep wells and high circulating pressures. A built-in sealed air chamber gives greater buoyancy, less fluid slippage, more efficient valve action and greatly reduced impact. In air the valve is approximately 20% lighter than other types of the same corresponding size. The reduced weight improves the efficiency and life of the valve by reducing destructive hammering and increasing the sensitivity of the valve to slight changes in fluid movements.

The air chamber is sealed with a large diameter tool joint thread that shoulders to give great strength and rigidity and prevents it from leaking or unscrewing in service. The valve only has three parts—valve body, cap and insert. As there is practically no wear on the cap it can be used over and over again, giving longer life and cutting the maintenance cost.



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KENNEDY pipe line valves have thoroughly proven their sturdiness, ease of operation and lasting reliability in installations all over the country. They are generously proportioned in every detail with massive bodies and flanges that resist distortion from pipe line strains and with strong, efficient operating mechanisms that assure tight closure and quick release.

Other Kennedy Valve types for the oil industry include 400-lb., 700-lb., 1000-lb., 1600-lb. and 2500-lb. test gate valves, together with valves for general service; and complete lines of malleable iron screwed fittings and cast iron flanged fittings.

Write for the Kennedy catalog which fully describes and lists all the Kennedy products.

The Kennedy Valve Mfg. Co.
Elmira, N. Y.

KENNEDY
VALVES-PIPE FITTINGS-FIRE HYDRANTS

by a mechanical timer and a small pump driven from the same unit.

The jacket water from the engine-driven unit is circulated through an interchanger which transmits heat to the oil. The engine radiator does not come into use unless water temperature exceeds the setting of a thermostat valve in the line to the radiator.

Oil not used for power fluid represents the amount produced from the well. This production is taken from the bottom of the lower compartment along with the water and sand. It is processed on the lease the same as oil from other producing wells. A back-pressure valve on the production-discharge line can be adjusted to hold any desired pressure on the filter tank. Float-controlled gas-discharge valves are provided for both

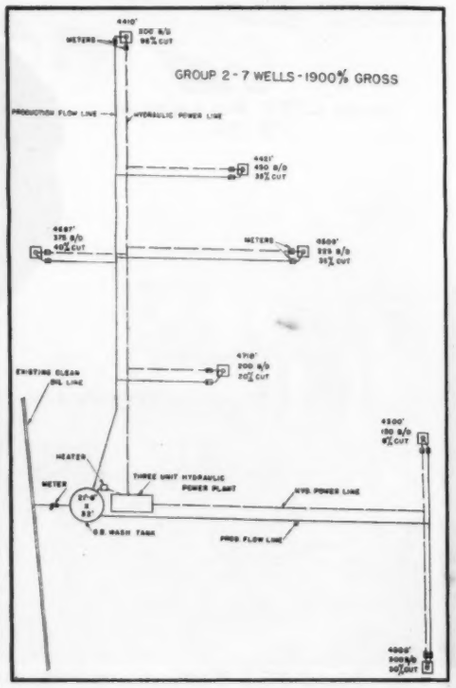

Diagram of central hydraulic installation

the separation and filter compartments to release the gas liberated in the compartments.

Special Features

When clean oil is available from dehydrators or other sources, filtering is not necessary and this further simplifies the operation of multi-well surface plants considerably. Also, when fairly high-gravity oil is produced, heating at the surface can be dispensed with. In the case of heavy oil, heating is an advantage; for not only does it make filtering possible but it also facilitates the separation of water and reduces the viscosity with a corresponding reduction in fluid friction. The hot power fluid slowly gives up its heat to the well fluid as it is pumped downward. This heating feature has been most widely used on wells where trouble has been encountered due to paraffin. In such cases the power fluid is heated to a temperature which will prevent formation of wax in the tubing. The oil moving upward in the production string is kept hot enough to keep all of the paraffin in solution.

When water is present in a well on which hydraulic pumping equipment is used, it is common practice to carry on the first step of treating in the well itself. This is accomplished by adding treating solution to the power fluid before it is pumped to the bottom-hole unit. During the return trip the solution is mixed with the well fluid to prevent the formation of emulsion and to break down emulsion already formed.

Some wells using hydraulic equipment produce

Cool More Efficiently—Prolong Engine Life

WITH THE

HAPPY COOLER

To supply the demand for a high efficiency unit to cool the jacket water of oil field Gas and Diesel Engines, the HAPPY Cooler is especially designed and built for oil field use. Operated on a closed system with a minimum of make-up water required (from 12 to 15 gallons) cleaner and purer water can more easily be supplied—

- SMALL QUANTITY OF WATER REQUIRED MAKES POSSIBLE USE OF RAIN OR DISTILLED WATER.
- PROVIDES MORE YEAR ROUND UNIFORM ENGINE TEMPERATURES.
- BY MAKING POSSIBLE USE OF PURER WATER IN ENGINE JACKETS ELIMINATES CAUSE OF SCALE FORMATION GIVING SMOOTHER MORE EFFICIENT ENGINE OPERATION.
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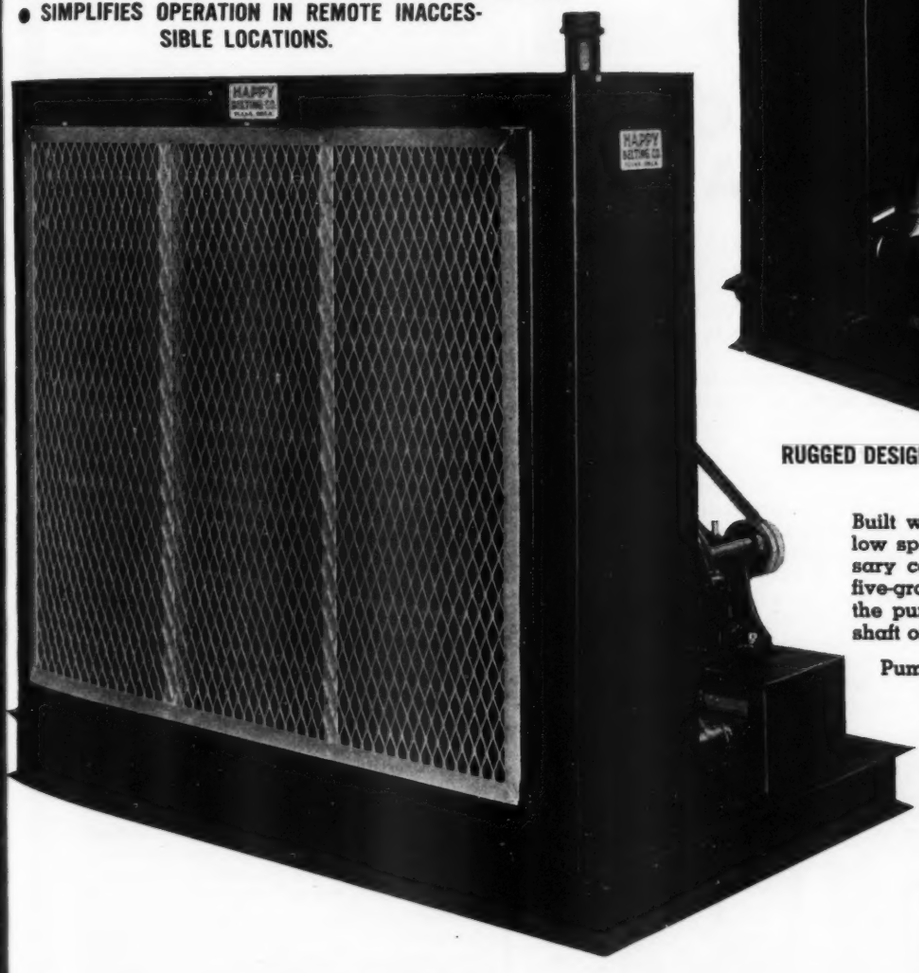
- SIMPLIFIES OPERATION IN REMOTE INACCESSIBLE LOCATIONS.



LARGE ROUND TUBE DESIGN

Core is made of round heavy gauge wall, seamless copper tubes, tested for leaks at 100 lbs. hydraulic pressure. The round tubes under normal conditions eliminate the danger of clogging.

ACCESSIBLE PUMP
Adjustable Drive

RUGGED DESIGN

WELDED CONSTRUCTION

Built with large diameter heavy duty all-steel fan, operating at low speed. Shaft carried on ball bearings of many times necessary capacity — assuring long life. Fan shaft supplied with a five-groove V-Belt Sheave, two of the grooves being used to drive the pump, leaving three grooves available for driving unit from shaft of engine.

Pump adjustable to take up any slack in V-Belts.

Unit may be supplied without front guard, as the flange on the front face of the unit provides a means of attaching a duct in order that the air may be directed in any desired direction. Suitable connection may be made so that the air may be directed outside in Summer and the building cooled, or directed inside and assist in warming the building in Winter.

HAPPY COOLERS Are Made in Five Sizes

Detailed information furnished on request. We will be pleased to recommend proper size unit when information as to size engine or compressor to be cooled is furnished.

EIGHTEEN YEARS OF LEADERSHIP

Happy BELTING COMPANY

310 EAST TENTH STREET, Tulsa, Oklahoma

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corrosive water, gas or oil. In these cases corrosion is being reduced by the addition of neutralizing compounds to the power fluid. This does not increase the volume of fluid handled, and it serves a very worthwhile purpose in prolonging the life of tubing and surface equipment.

The hydraulic pump is made in nominal sizes of 2 inches, 2½ inches, 3 inches, and 4 inches. Each size is of sufficiently small external diameter so that it can be run in tubing of the same nominal size. Thus a 2-inch pump inserts into 2-inch upset tubing. The power-fluid strings range from three-fourths inch, which is used with a 2-inch pump, to 2-inch, which is used with a 4-inch pump. Producing capacity varies greatly with the size of the subsurface pump and the speed at which the triplex pump at the surface is operated. The capacity range is from a few barrels to about 1,000 bbls. per day. For the very small producers it is possible to use an automatic intermitter on the surface power pump in order to cause intermittent pumping of the well. This can be accomplished where either an electric motor or an internal-combustion engine is used for the prime mover. However, most operators prefer to regulate the speed to a rate of pumping which will permit continuous operation.

Depth of wells is not a limiting feature in hydraulic pumping, because it is only necessary to design the equipment to withstand pressures corresponding to the well depth, whatever that may be. The present pumps are designed for working pressures up to 4,000 pounds, and this corresponds to a maximum depth of about 10,000 feet. Wells of 8,600-foot depths are now being pumped. The hydraulic pump is not handicapped by crooked holes, except in rare cases where kinks are too sharp to permit the pump to reach bottom.

CASE

CUTS COSTS AND CARE AT CORSICANA

● Driving the modern unit shown below, this Case Model LE oil field engine replaced old style, inadequate equipment at Corsicana, Texas. It pumps 1500 barrels, about 98% water, from 2800 feet.

The more difficult the job, the more you need Case. Flat torque and accurate governing for full power over a wide range of speed . . . dust-sealed design and oil-wash air cleaning to keep dirt out, upkeep costs down . . . automatic pressure lubrication to all important points that cuts attendance time . . . automatic cutouts available for instant protection if temperature goes up or oil pressure goes down . . . honed cylinder sleeves—evenly cooled, long-lived, easily renewed on location. Two sizes, 35 and 55 H.P. Fitted for gasoline, natural gas, or both. Details from distributor or direct from factory.

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Distributed and serviced in the Mid-Continent field by Southwest Equipment Co., Dallas and Kilgore, Texas. Stocks at Dallas, Houston, Kilgore, Texas; Shreveport, Louisiana; Oklahoma City, Oklahoma; Wichita, Kansas.

Power Plants Installed

(Continued from Page 193)

feeder panel is a 200-ampere 5,000-volt oil circuit breaker with a magnetic overload trip. Also on this panel are a voltage regulator and a watt hour meter. On a swinging bracket attached to the feeder panel a synchroscope and an A. C. voltmeter are mounted.

The lease power load varies widely. In spite of this the voltage is held steady under all operating conditions. On one test, which was made to check the operation of the voltage regulator, two alternators were running in parallel and carrying a light load. The A. C. ammeters showed rather violent swings from 10 to 30 amperes for each machine, but the variation in voltage was hardly perceptible. Load variation is expected to be even more severe when the electric drilling rig begins to operate on the lease.

The extent to which electric power is utilized on the Evans lease is indicated by the fact that cooling-water circulating pumps for the gas engines are electric-motor driven. Usually these are operated by belt drive from the engine shafts. The air compressor in the station is provided with both electric-motor and gas-engine drive. This feature insures a source of compressed air for starting the engines even after a complete shut-down of considerable duration.

An interesting feature of the new power plant is the fact that the resident lease pumper acts as plant engineer at all times. In other words, the entire lease is operated by one man who only requires help when repairs are needed at the wells. The engineer-pumper only spends a few hours at the power station each day although it is in continuous operation 24 hours per day. Automatic control is so complete that it is said that the worst thing that can happen to the plant is to have it shut itself down. For example, temperature switches on the gas engines will shut the engines down in case the circulation of cooling water should cease, or in case the engines should become overheated for any other reason.

National Oil Co. is the only California company operating lease power plants. Their first plant was constructed about three years ago in the Kern Front field near Bakersfield and consisted of only one gas-engine driven alternator, but an additional set was added when the lease load increased. The success of the first plant led to the construction of the new plant in the Hovey Hills.

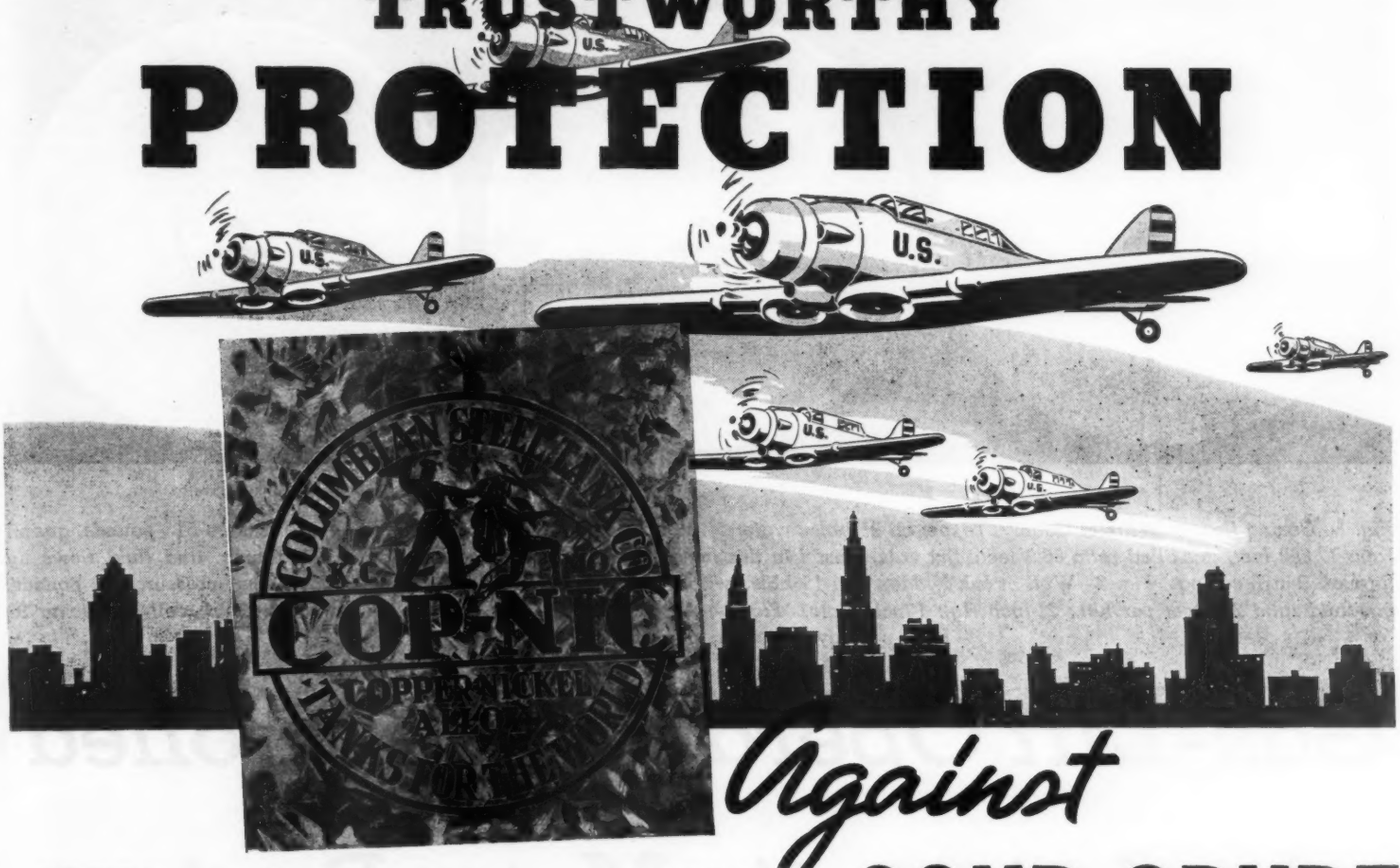
New Edition on Fire Codes for Flammable Liquids Available

The 1938 edition of "The National Fire Codes for Flammable Liquids and Gases," compiled by Robert S. Moulton, technical secretary of the National Fire Protection Association, has been published and copies are now available from the association, whose offices are in Boston, Mass., at a price of $1.50.

This 360-page volume includes the 36 standards and regulations giving fire protection authorities complete information on the safe handling of both flammable liquids and gases. The several codes are in the form of suggested ordinances, regulations, or recommended good practice requirements and are purely advisory as far as the National Fire Protection Association is concerned, but are widely used as a basis of law, or as a guide by administrative authorities in the exercise of their discretionary powers, as well as for insurance purposes. Prepared by technical committees including engineers representing all major interests concerned, they are universally accepted as the authoritative guides to the best practice in fire prevention and fire protection.

Typical examples of the 36 standards are: Flammable liquids ordinance, marine oil terminals, tank truck ordinance, oil burner regulations, kerosene or oil stoves, liquefied petroleum gas code (propane and butane), dry cleaning and dry dyeing, paint spraying and spray booths, city gas, gas systems for cutting and welding, and fire hazard properties of flammable liquids, gases, and volatile solids.

TRUSTWORTHY PROTECTION



Against SOUR CRUDE

HERE is trustworthy protection that lets you cast aside all fear of the destructive invasion of sour crude. With COLUMBIAN COP-NIC Galvanized Bolted Steel Tanks on the job, your tank investment is SAFE!

COP-NIC steel, with a special galvanized coating, makes Columbian Bolted Tanks highly resistant to corrosive action and perfect for use in sour crude districts. The sheets from which these tanks are made are of selected base material. An exclusive galvanizing process is used to put on a heavy coating of zinc spelter which is applied in such a manner as to become virtually a part of the steel itself, minimizing the possibility of any pitting or loosening of the coating.

The outstanding successful results obtained with COP-NIC Galvanized Tanks are attributed to the process used in the preparation of the sheets, of the coating and the manner of fabrication which does not destroy or render ineffective the galvanized coating.

Protect your tank investment with Columbian COP-NIC Tanks. WRITE now for free illustrated catalog giving all the facts.

COLUMBIAN STEEL TANK CO.
KANSAS CITY, MISSOURI

Built Especially for Storing Sour Crude . . . Last Longer in Ordinary Service!

(At left) A battery of *Columbian COP-NIC Tanks in a sour crude district.*

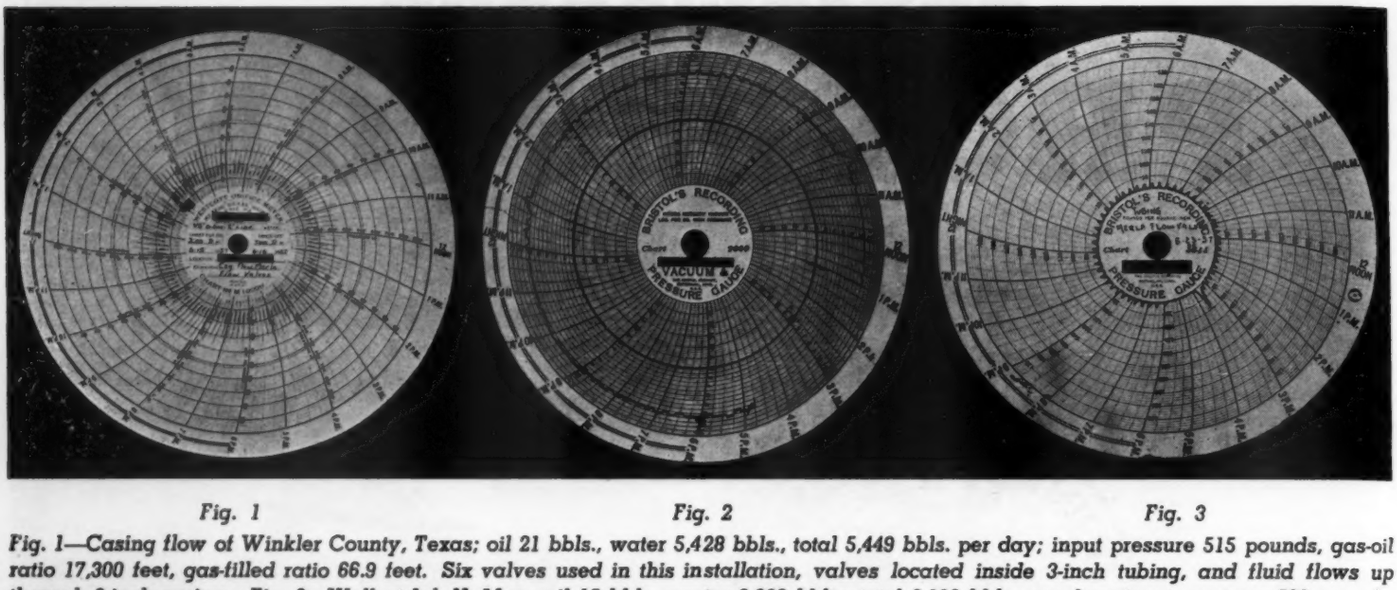


Fig. 1 *Fig. 2* *Fig. 3*

Fig. 1—Casing flow of Winkler County, Texas; oil 21 bbls., water 5,428 bbls., total 5,449 bbls. per day; input pressure 515 pounds, gas-oil ratio 17,300 feet, gas-filled ratio 66.9 feet. Six valves used in this installation, valves located inside 3-inch tubing, and fluid flows up through 9-inch casing. Fig. 2—Well at Jal, N. Mex.; oil 15 bbls., water 2,096 bbls., total 2,112 bbls. per day; input pressure 580 pounds, gas-fluid ratio 228 feet per bbl.; 21-inch Hg.; 1-inch plate. Fig. 3—Another tubing flow installation on small fluid well producing 96 bbls. per day; input gas-oil ratio 616 feet per barrel

Gas-Lift Operation Controlled by Automatic-Meter Device

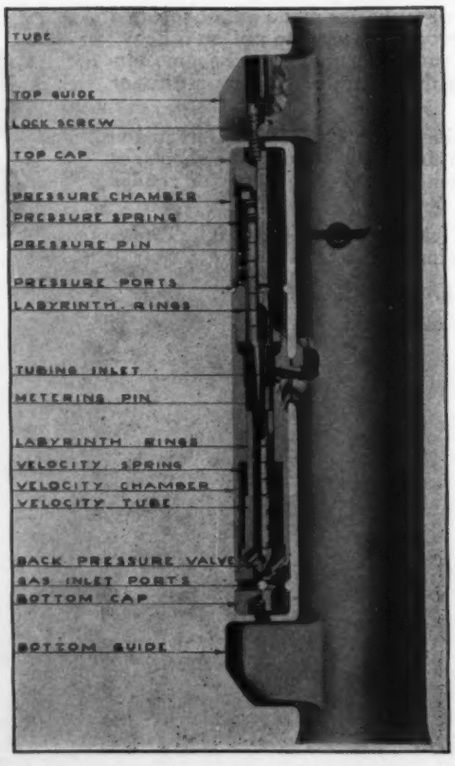
By C. S. CRICKMER
Merla Tool Co.

Progress in the gas-lifting of oil-well fluids has reached the point where engineers no longer are interested primarily in the theory of this production method, but instead are concerned equally with the different types of flow-valves, their settings, and range of flexibility under all well conditions.

Contrary to the original thought that the gas-lift principle was only a physical application of pressure, it is now generally understood that it is the result of expanding gases and aeration applied at the right points and in the right proportions in the flow-string. Flow-valves have been developed to make this possible. In fact, the proper control of the volume and place at which extraneous gas pressure is introduced through flow-valves into the fluid column is an important determining factor in efficient gas-lift operation.

To meet this requirement, an automatically controlled pressure and volume (or metering) flow-valve, operated at differential pressures existing across the valve between the gas and fluid columns, has been perfected and found highly efficient under a wide range of conditions.

Briefly, this flow-valve is a differential-pressure mechanism mounted inside or outside of a tubing-nipple joint (depending upon whether for casing or tubing flow) and run to predetermined points in the tubing-string. In referring to "tubing-flow" or "casing-flow" settings, the fluid column is the designating factor. For instance, where gas is introduced down the casing and flow of formational fluid is up through tubing, this is considered a "tubing-flow" setting. By placing the valves outside the tubing, the string is left open for making subsurface tests, etc., so for that reason, if no other, tubing-flow installations are popular. However, in large water wells, where fluid volumes to be lifted are very great, the casing-flow setting is often desirable.



Cut-away section of automatic metering type flow-valve

In either type of setting, a differential pressure is set up across the flow-valve between the fluid level in the flow column and the gas pressure applied extraneously, or from the formation itself. The automatic metering device admits the proper volumes of gas through the valves into the fluid column at all times to expand and afford the necessary aeration for lifting fluid to the surface. If insufficient gas is admitted through the valve, no oil will be lifted. If too much gas is delivered, it will either close the valve or will bypass through the fluid column, because of its excessive pressure, without doing any work toward lifting the fluid. The function of the metering device in this valve is to eliminate both conditions and to deliver the gaseous pressure to the moving column of fluid according to its rate of movement or as it needs it.

In accomplishing this automatic metering of gas into the flow column, the flow-valve is divided into two cylinders above and below the gas-inlet pipe entering into the fluid column. Gas ports admit gas into the upper and lower cylinders. The chamber between these two cylinders is connected to the tubing inlet (on tubing-flow settings) and should be considered a part of the flow area. Gas entering the ports in both the upper and lower cylinders acts upon the metering pin (upper) and the velocity tube or seat (lower) to meter gas automatically into the fluid column in proportion to the needs of each particular movement. The auto-

matic sensitivity of this metering pin to the fluctuations of the pressure differential existing between the incoming gas and the fluid being expelled from the well permits continuous flow under all conditions. Each valve in the setting acts independently of the others. The gas metered through each valve into the tubing is automatically controlled by the differential pressure set up, due to movement of the fluid in the tubing at the point at which each valve is located.

When running into the well, valves are closed against back-pressure until gas pressure is applied, and will again close against excessive pressure entering the flow column. When the fluid buildup over the inlet port is sufficient to act upon the metering valve, gas is admitted to the fluid column, the amount being metered is determined by the size orifice afforded by the tapered meter pin, which is actuated in direct proportion to the back-pressure exerted in the fluid column.

In order to avoid having nothing more than an equalized pressure condition, springs are added above the metering pin and below the velocity tube to assist in opening valve against gas pressure. In other words, the springs actually afford the differential pressure so that they open under a lower fluid pressure than when they have gas pressure across the valve. This differential can be changed to suit individual depth and fluid conditions. Springs are supplied in 5-pound increments, i.e., 15-pound, 20-pound, 25-pound, etc. For instance, with a 20-pound spring a differential of 90 pounds is given across the valve; for a 25-pound spring a differential of 123 pounds is afforded. Where heavy fluid conditions demand, stronger springs may be had to provide additional differential pressure. The springs are in an unstressed position when the valve is not in operation.

Pins of three different curvatures were tried in both the laboratory and the field before perfecting the one which would afford a uniform area (or ring) orifice between the pressure pin and the velocity tube at all pin positions. A blunt or poppet-type pin was first tried, but it was immediately seen that very little change in orifice area occurred until the pin was at or near its final seating point, and therefore afforded no uniform metering characteristics. Next, the conical pin (straight-line pointed) was tried, and although a much wider range of orifice area was afforded in the different pin positions, it was considered unsuccessful because toward the end of the movement the rate of area change per unit of pin movement was considerably less than at the points where the pin was first entering the tube. As a uniform area should obtain for each unit change in differential pressure (which determines the pin position), this was not satisfactory. Finally, a logarithmic curved pin was developed, which afforded uniform orifice area for all pin positions extending between the fully opened and closed positions. In other words, the orifice is opened directly in ratio of one to another. This, of course, is very important, because the amount of fluid pressure exerted on the valve at the point where it is located in the well, when in operation, is dependent upon the rate of flow. It naturally follows that at a high rate of flow, less gas need be added to the fluid column; this is accomplished by the metering action. Since the valve is operated by differential pressure, and pressure is governed by the need for gas, where the need is low the pressure will be low, and consequently the valve will tend to close.

When fully opened, the valve permits large quantities of gas to flow through it, giving an initial slug at high pressures to overcome inertia of dead loads. This is particularly important in intermittent-flow settings where one valve is used.

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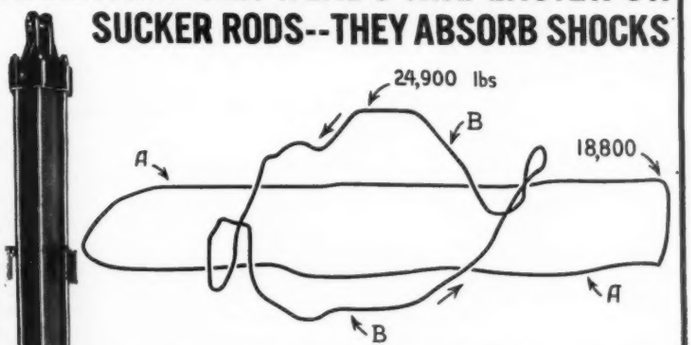

(A) Sullivan Pumphead card taken at 11½-132 inch s.p.m. Tapered string of rods, 6427 feet long, consisting of 2400 ft. of ⅞" and 4027 ft. of ¾". With 1¾" plunger, well produced at the rate of 476 bbl. per day, 38° oil, no water. Apparent volumetric efficiency 87.9 per cent.

(B) Walking Beam card taken at 16.8-74 inch s.p.m. Tapered string of rods, 6410 feet long, consisting of 2410 ft. of ⅞" and 4000 ft. of ¾". With 1¾" plunger, well produced at rate of 370 bbl. per day, 38° oil, no water. Apparent volumetric efficiency 83.4 per cent.

THE peak of card B, so characteristic of the walking beam, does not appear in card A, which is typical of the Sullivan Pumphead. This is due to the shock-absorber effect of the Sullivan Pumphead.

The stresses in the top sucker rods, in pounds per square inch, are 41,450 for the walking beam, compared to 31,300 for the Sullivan Pumphead. A reduction of 24.5 per cent. It is not strange, therefore, that the relative frequency of sucker rod jobs is three per *year* for the Sullivan Pumphead against three per *month* for the walking beam. A potential saving of $3,300.00 per year at $100.00 per job!

An article, "The Sucker-rod Pump as a Problem in Elasticity," contains information of interest to users of sucker rods. Send for your copy today.

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SULLIVAN PUMPHEADS

Several Advantages Offered by Sullivan Pumping Unit

Fig. 1 — Typical pumphead installation on a 6,700-foot well in a Mid-Continent field

The Sullivan pumphead type of surface equipment, used for pumping wells with sucker-rods and tubing, has been successfully used for several years and has been found to have several definite advantages of value in producing wells.

This method utilizes a single-acting cylinder suspended in the derrick by means of pull-rods. The piston-rod from this cylinder is attached to the sucker-rods. The piston is actuated by compressed air or gas, imparting a straight-line reciprocating motion to the string of rods. Intake air or gas pressure introduced below the piston is sufficient to lift the weight of the rods and fluid and forces the piston upward. Ot the end of the stroke the valve mechanism reverses and the discharge pressure is maintained at a pressure sufficient to support the load during downstroke.

The complete system (see Figure 1) consists essentially of the compressor unit, heater and pumphead. The heater serves two purposes: First it prevents freezing and second, it increases the volume of compressed air or gas and thereby results in lower horsepower required for operation.

Compressed air or gas required in the operation of the pumphead can be obtained in any one of four ways:

1. Individual well compressor unit.
2. Central compressor plant.
3. High-pressure gas line.
4. High-pressure gas well.

For installations utilizing either the individual or central compressor plant, the discharge from the pumphead is piped back to the intake of the compressor resulting in a low-compression ratio and resultant low-compression horsepower.

Throughout the entire pumping cycle, the string of sucker-rods is protected by a cushion of compressed air or gas. The pumphead is, in fact, a giant shock absorber permitting the string of sucker-rods to adjust themselves to changes in the elastic reactions without fear of overstress. The maximum rod stress is limited by the pressure carried in the system, and if the weight of the well should exceed this, as is frequently the case when the plunger sands up, the pumphead will stop. The operation of the pumphead on a constant pressure makes it follow a constant velocity cycle, which may be modified slightly by the elastic reaction of the rods. This eliminates the peak polished rod load and the upstroke line of the dynamometer card is flat. Figure 2 shows an indicator card taken from a pumphead.

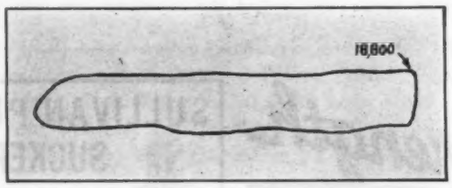

Fig. 3—Typical dynamometer card. The figure shows low maximum peak load

Unsanding Valves a Feature

Where bad sand conditions are encountered, the unsanding valves, which are standard equipment on the pumphead, may be used to free a stuck plunger by operating the head manually. It has been found that the action obtained by operating the pumphead piston up and down manually is much more effective in freeing the plunger than a much greater steady pull and there is no danger of injuring the string of rods. This feature alone often eliminates the necessity of a rod pulling job.

The length of the stroke can be readily changed by moving the upper reverse port of the valve up or down to a different tapped opening provided in the pumphead cylinder for this purpose. A wide variation in the speed may be obtained by adjusting the two throttle valves located in the inlet and discharge lines to the pumphead. The speed of the upstroke is independent of the downstroke. Thus, it is possible to operate with a slow upstroke and fast downstroke or vice versa; whatever is necessary to operate the well at the highest possible efficiency.

Fluid Pound Eliminated

Figure 3 shows a series of two cards taken from a well, the first card which shows the well pounding fluid. In an attempt to eliminate the pound, the stroke was shortened but this did not correct the condition. In the pound card the speed of the upstroke was 16.5 strokes per minute and the downstroke 9.4 strokes per minute, giving an

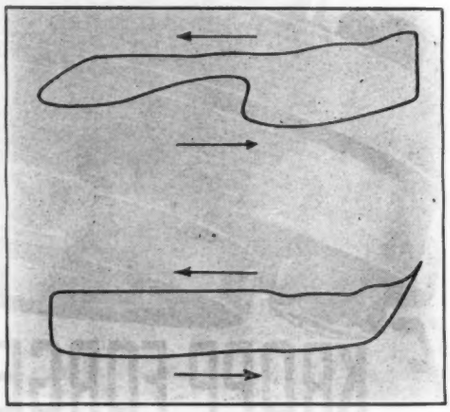

Fig. 4—Top, indicator card, made with a fast upstroke, shows pronounced pounding. Lower card, made with a slow upstroke, shows pounding eliminated. This well was operated at 12 strokes per minute in both cases

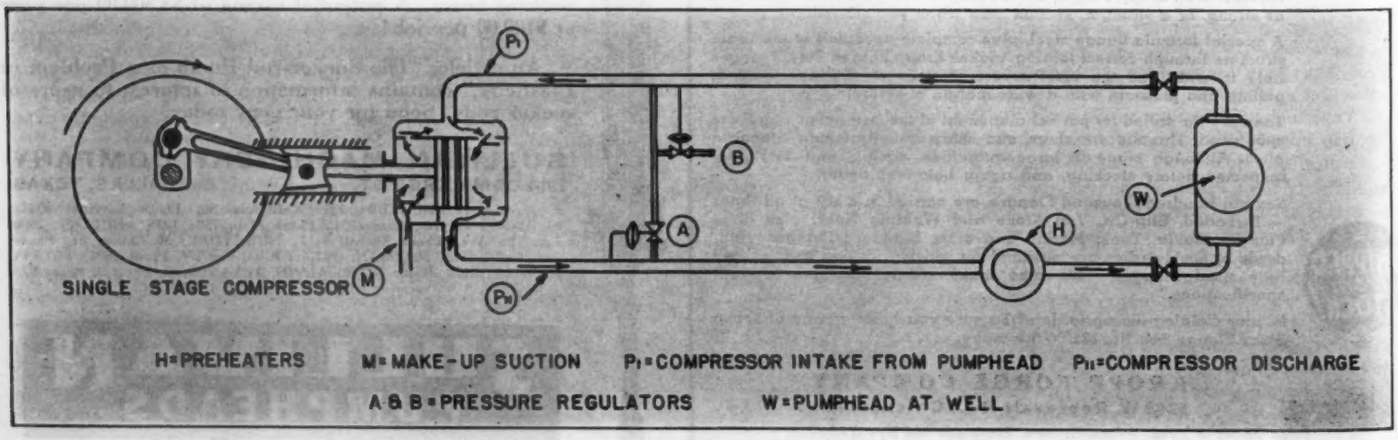

Fig. 2—Schematic drawing of single-well Sullivan pumping unit

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average speed of 12 strokes per minute. The speed of the upstroke was reduced to 8.6 strokes per minute and the down stroke increased to 25 strokes per minute with the average speed remaining 12 strokes per minute. As a result the pound disappeared as shown in the second card. A distinct advantage resulted in this case by reducing the pressure drop through the standing valve and correspondingly reducing the liberation of gas in the pump barrel. The strokes per minute remained the same but the production increased materially by independent control of upstroke and downstroke.

Due to the fact that the complete installation requires no heavy foundations or other permanent items, the first cost is low and comparable to first costs of other oil well pumping units. It is also a fact that the single initial well installations can be used for pumping over the entire producing life of the well. In addition the entire equipment is completely salvagable.

The size and layout of the surface-plant varies with several factors, chiefly the number of wells to be pumped by the one compressor plant. When high-pressure gas from a well or from a field gas system is to be used, the surface plant is considerably simplified. Otherwise the main elements consist of the pneumatic pumpheads, heaters for heating the compressed air or gas before it goes to the pumpheads, supply and return gas or air lines, the compressor which is connected between these lines, and two regulators. As there is some leakage from the closed system and some compressed air or gas is used to operate the pumphead valves and lubricator, a source of make-up is required. By increasing the size and number of compressors in the compressor plant, the number of wells operated from the central plant can be increased. Both individual and multi-well installations are in use.

Applications

Suspended, as it is, from derrick or tripod, the Sullivan pumphead lends itself to installation in difficult country. On low ground, flooded at certain times of the year, in lakes, or along shores of the oceans, wherever the snowfall is heavy, on swampy ground, where foundations for heavy equipment are expensive, or cannot be built at all, or in fields in which the terrain is ideal, the Sullivan pumphead can be used advantageously.

The several cylinder bores from 5¾-inch to 11-inch and stroke from four feet to 15 feet makes available equipment to cover a wide range of application. Four sizes of heaters are manufactured covering a wide range of compressed air or gas heating capacity. Skid-mounted compressor units for individual well units or for furnishing compressed air or gas to more than one well are also manufactured. These range in size from 25 to 100 hp. and a compressed air or gas capacity from 400,000 to 2,000,000 cubic feet per day.

Sullivan pumpheads have demonstrated over several years operation many definite advantages. A few advantages are: (1) Maximum rod stress positively limited; (2) reduction in sucker-rod breakage; (3) straight line pull; (4) no counterbalancing troubles; (5) any length stroke from 4 feet to 15 feet; (6) length of stroke variable on each size head; (7) strokes per minute variable over wide range; (8) upstroke speed entirely independent of downstroke speed; (9) ease of weighing well.

Conclusions

The record of the pumphead operation has shown that it has ability to pump both large and small volumes of fluid at a reasonable cost. Field records show that there has been a low average rate of sucker-rod failure and high general efficiency of operation. This satisfactory performance is due to the long stroke with the shock absorber effect and the very definite limit of maximum rod stress in conjunction with its general flexibility of operation. The lower peak polished-rod stress, resulting from operation on the so-called constant velocity cycle, has made it practical to operate a relatively large plunger under field conditions of low fluid level. These combined have made operations at relatively higher polished-rod velocities practical with the regular tapered string of seven-eighths inch and three-fourths inch rods.

Plunger Lift Proves Successful in Pumping Deep Production

The Hughes plunger lift has been in operation for a number of years in oil fields throughout the world, and is accepted today as a valuable contribution to the art of producing deep oil wells. It is adapted to supplement gas-lift operations in those wells where bottom-hole pressures have declined to a point where straight gas lift is no longer economical.

The operation differs from ordinary gas-lift in that the fluid is raised from the bottom of the tubing in charges, or "slugs," each load being lifted the entire distance and discharged at the surface before the next charge is picked up. This action is accomplished by the use of a hollow metal piston or plunger, which fits loosely in the special tubing string and is propelled from bottom to top by the pressure of gas below it. A fluid seal is maintained between plunger and tubing wall, which prevents the escape of gas past the plunger. A valve in the lower end of this plunger automatically drops open when the fluid is discharged at the surface, and the plunger then falls back to the bottom, where it settles rapidly through the rising column of oil and gas and strikes a cushion seat which closes the

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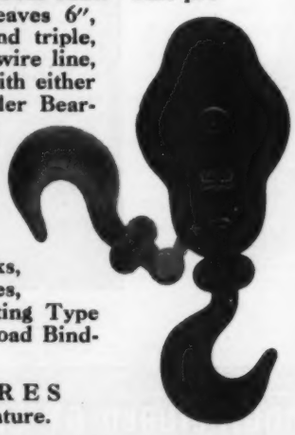

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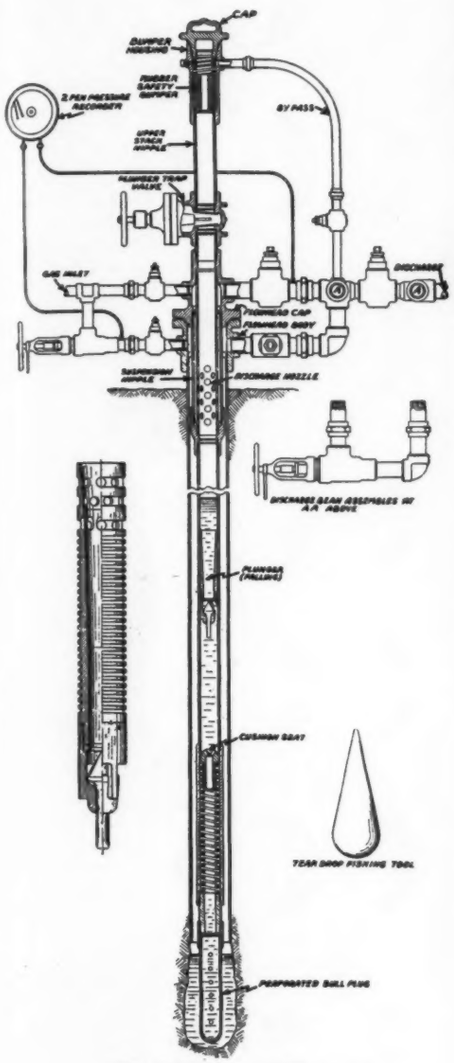
valve, so that gas pressure again forces the plunger toward the surface. The complete arrangement, as installed in a well, is shown in the accompanying diagram.

Due to the reduced operating pressure required when the fluid is raised in separate charges as described, production is frequently increased from 50 to 100 per cent by the installation of a plunger lift, and appreciable reduction in gas-oil ratios is obtained. Tubing sizes on existing installations range from 2 to 4 inches, the larger sizes being recommended where production is large and productivity index high.



Hughes plunger-lift pump

Average maintenance expense is extremely low, approaching that of flowing wells where conditions are favorable. In many cases where wells can no longer be made to produce by natural flow, the plunger lift will operate for several years before addition of input gas is required. Overall lifting costs, even in cases where all of the gas required for operation must be introduced at the surface, compares very favorably with other methods of pumping oil wells, and as producing depth becomes greater, the comparative advantages of the plunger lift should become increasingly evident.

The following table indicates the approximate net operating pressure in pounds per square inch at the casinghead required to produce 100 bbls. per day of 40-gravity oil from a depth of 6,000 feet.

Size of unit—	Production rate, bbls./day	Operating pressure, lbs./sq. in.
2-inch	100	140
2½-inch	100	87
3-inch	100	55
4-inch	100	25

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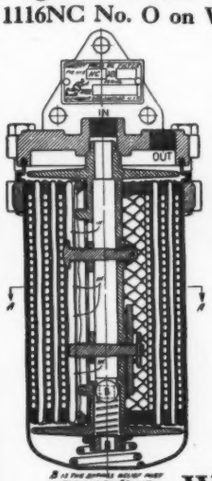
Nugent Patented Lubricating Oil Filters Fig. 1116NC No. 1R on Weber 50 H.P. Gas Engines for oil well pumping, Skelly Oil Co., Fitts Pool, Ada, Oklahoma.

Nugent Patented Fuel Oil Filters Fig. 1116NC No. O on Weber 50 H.P. Diesel oil well Pumping Engines belonging to the Empire Oil & Refining Co., Russell, Kansas.



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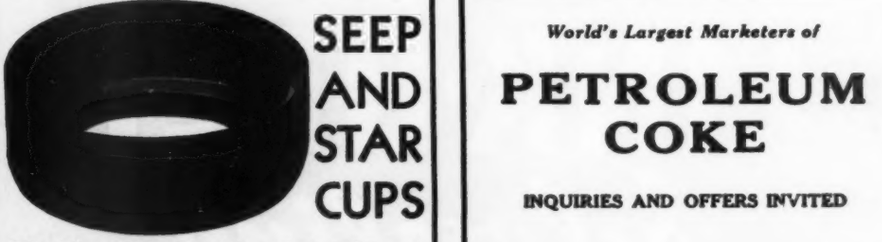

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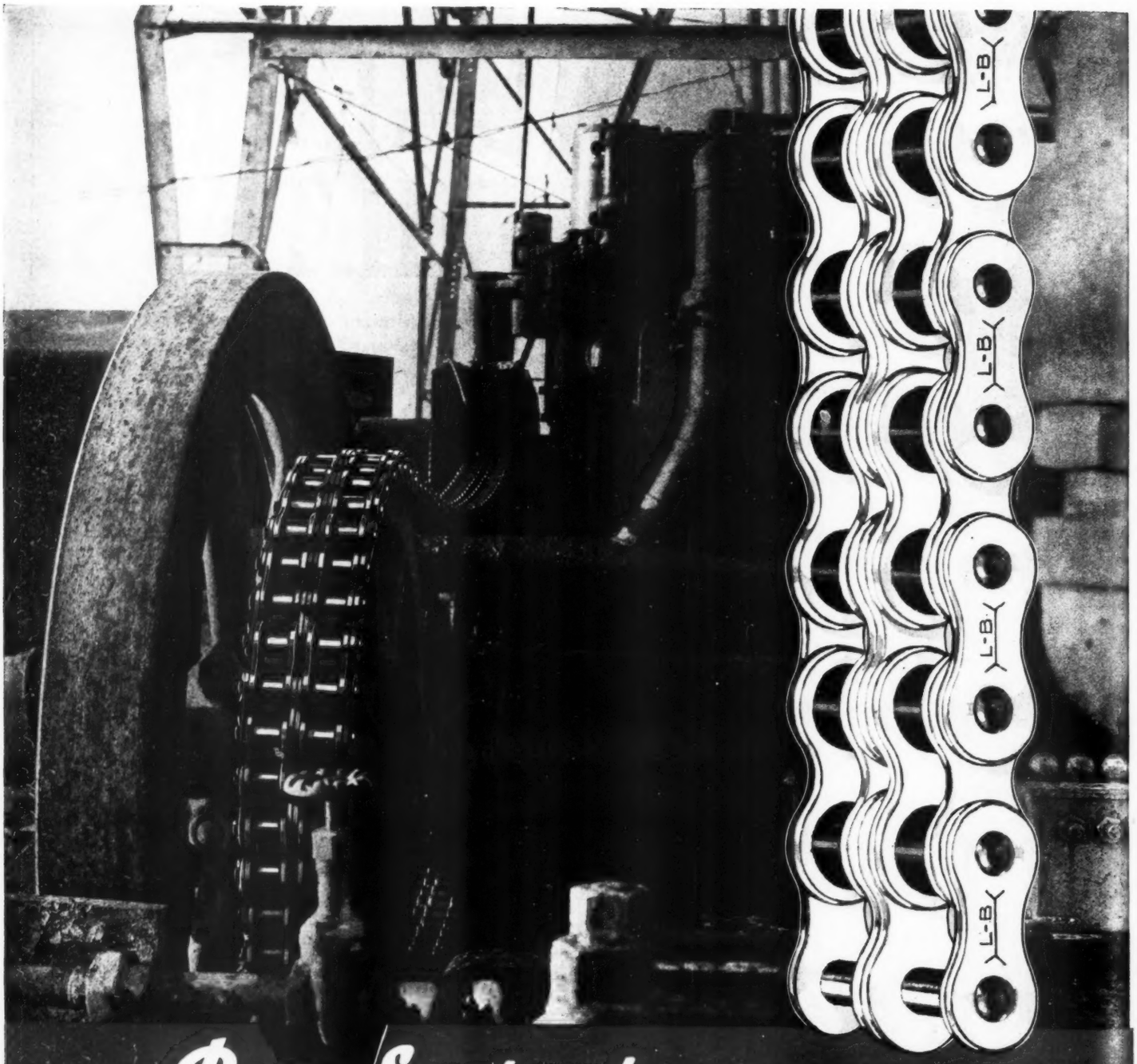

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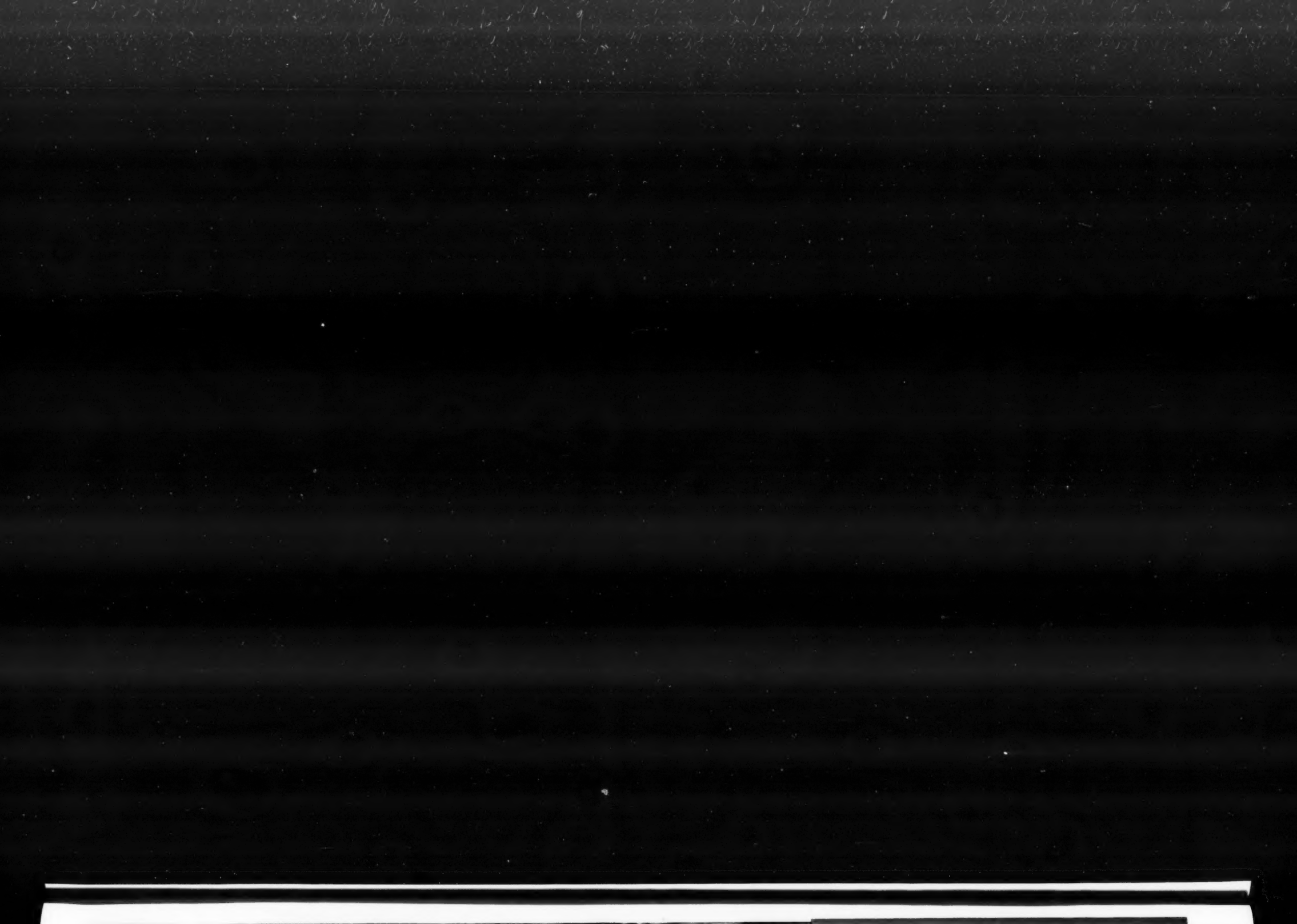

Pendulums for road crossings provided with guards for protection against water, dirt, and other obstructions getting into the pits

Swings and Rod-Line Devices for All Types of Topography

Probably because of the simplicity of their design, pull rod swings, supports, pendulums, hold-downs, hold-ups, tie-backs, rockers, multipliers, etc., reflect more originality on the part of the individual operators than any other type of surface equipment they may use. This originality is as much, if not more, evident in the Pennsylvania Grade crude oil fields than in others because of the fact that nearly all of the 140,000 wells in this area are pumped from central powers located to a large extent in hilly and mountainous country.

For that reason, much of the following discussion concerns these fields, particularly in McKean and Venango counties in Pennsylvania, where there are approximately 55,500 wells, more than one-seventh of all the producing wells in the country. A one-day trip through the high-cost properties in these counties will reveal hundreds of original devices, most of them of inexpensive construction, in the line of accessory rod-line equipment.

Because of the rugged topography of this region and because it is thoroughly covered with improved highways and has numerous streams and railroads, the operators are faced with a variety of problems in erecting rod lines that will operate with a minimum of power requirements, friction and wear, and yet with a maximum of efficiency.

Principal accessory rod-line equipment can be listed, for the sake of convenience, under these headings: Take-off or knock-off posts or rails, hold-downs, hold-ups and swings. Each of these has a multitude of variations depending on the needs of the particular location and the equipment the operator can afford. Take-off posts provide a means of disconnecting a well from the power; hold-downs and hold-ups, in addition to performing the service indicated by their names, also serve to alter the vertical direction of the line, while swings are used to change the direction horizontally.

Important considerations in the construction of take-off posts or rails are speed and safety. Power loss is avoided and friction is reduced by making

Modern bandwheel power installation

their plane the same as that of the power from which they operate. Those used commonly in the Bradford field are wide enough that most of the side play in the lines is confined to them, thus eliminating wear on a greater number of rods.

Supports are almost as numerous in variety as there are oil properties. Almost every operator, apparently, has some idea of his own which he incorporates in his surface equipment in accordance with topographical conditions and whatever material is at hand.

Most common types of pull-rod supports or hold-ups in use in the Pennsylvania fields are three- and four-legged tripods made from quartered logs. Discarded tubing is also used in this type of construction.

Single or friction-post supports are even more common and are generally set low enough so that when the line is taut, it is lifted partially above them, thus cutting down on friction and wear.

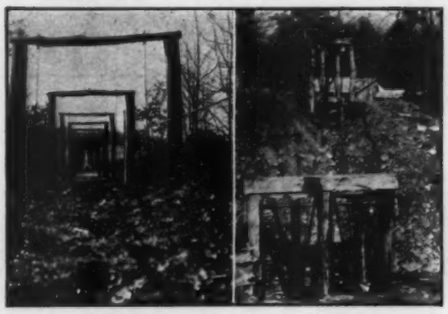

Fig. 1—(left) An aisle of twin line hold-ups. Fig. 3—(right) V-type pendulums transmit power under roadway

A most unusual view of a rod-line hold-up is shown in Figure 1. This aisle of lines transmits the reciprocating motion from an eccentric a quarter of a mile distant to a turntable. This homemade turntable is set on a housed concrete block, and in turn is pumping 15 wells. This Warren County, Pennsylvania, operator thus reduces his total rod-line footage.

While trees are not infrequently used for swing posts, they are not so common as rod-line hold-ups. An operator near Pleasantville, Pa., has simply lodged a pipe in the branches of a tree, and supporting hooks hang from either end.

An unusual practice in rod-line hold-ups is employed by an operator developing a recently purchased property on the outskirts of Bradford, Pa. His posts are 2-inch pipe set in heavier, larger pipe driven deep into the ground with air hammers. The supports are lined up and leveled with a transit. A guy wire is strung along the higher posts

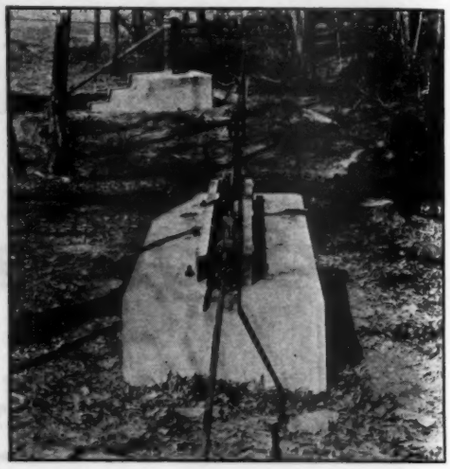

Fig. 2—Large concrete blocks for swing posts and hold-downs in lowland settings

and has been found to be highly efficient in eliminating vibration.

Several pumping powers in the Olympic pool of Oklahoma are equipped with 4-inch channel irons as rod hold-up and hold-down slips, providing a perfect guide for the pull rod. A hickory block fastened to the rod coupling travels in the channel lubricated with heavy grease. The channels are welded to the guide post, which is an 8-inch pipe

Fig. 4 (left)—Well pumped from overhead highway crossing on banks of Oil Creek in Venango County, Pennsylvania

Fig. 5 (right)—High flying rod line crosses the busy Oil City-Titusville highway in Pennsylvania; jack mounted on stilts to get full benefit of stroke

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You can't tie a JENSEN Straight-Lift Pumping Unit.

Made to lift oil smoothly, steadily, and without interruption. Extremely economical and dependable. Made in a plant devoted exclusively to pumping equipment for nineteen years. Perfected through the co-operation of many of the best production men in the business.

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You'll like JENSEN Straight-Lift JACKS. Easy to install. Easy to counterbalance. Easy to move back when the well needs service. Simple and sturdy.

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MONO-CAST DOUBLEX SIMPLEX PIPE

PHOTO shows 8", 16" and 6" Mono-Cast Doublex Simplex Pipe being installed in mains conveying natural gas at high pressure through thickly populated areas in a northern state. Although the terrain was quite rugged, and the ditch as deep as 15 feet in some places, the inherent flexibility of the Doublex Simplex Joint and the ruggedness of the pipe made the use of fittings or protective measures unnecessary. Mono-Cast Doublex Simplex Pipe has been convincingly field-proven, and is now being extensively used for high pressure gas and oil transmission and distribution lines with complete confidence throughout the United States and in foreign countries. For literature address—

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set in concrete. A similar practice is used by a Venango County, Pennsylvania, operator, except that, instead of channel irons, he uses a 4-inch pipe with an opening in the top large enough for the connection between coupling and the block to slide back and forth.

Hold-downs are as numerous in a variety of forms as are the hold-ups.

Large concrete blocks for hold-downs have been found to be economy in the long run by an East Texas operator, particularly in lowland settings (Figure 2).

To reduce the costs of operating its pumping equipment, one company has installed homemade hold-downs on its North Texas lease. This hold-

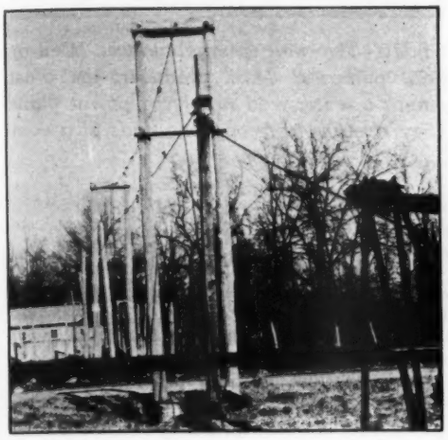

Fig. 6—Oklahoma operator uses rollers on discarded tubing for rod-line supports

down consists of a wooden wheel, rotating in journal boxes mounted on two pipes and set in concrete. Thus the rod is held down to the desired level with a minimum amount of friction, since the wheel is free to rotate as the line moves.

Three different types of hold-downs used for road crossings on Middle district, Pennsylvania properties, are illustrated in picture. Walls constructed of flat stones have provided an effective protection for the one in Figure 3. Good drainage is essential in these installations, for freezing water has tied up hold-downs of this type for long intervals in the commonly cold winters of this area.

Highway crossings present problems to many operators in the Pennsylvania area. One Middle

Fig. 7—Wheel swing for 90-degree turn

district operator sets his jacks on stilts so that the angle of the vertical bend from the hillside power will not be too great. A double-jack arrangement is employed on these wells, as may be noted in Figure 4. Another type of elevated jack answering the same purpose is shown in Figure 5. This rod line crosses the heavily trafficed Oil City-Titusville road in Pennsylvania.

Fig. 8—Beam swing at different angles

At least one operator in the Bradford field tried housing hold-downs in huts used on a road underpass.

Multiple crossings are achieved by another Bradford operator, who erects U-shaped supports made of pipe at either side of the road. One set of hold-downs changes the vertical direction of the lines at their normal level, and another set changes the direction at the desired clearance level. The lines are supported on the crossing from guy wires strung above them.

Sheave or roller hold-downs are used by a Middle district, Pennsylvania, operator for one type of individual-line road crossing, while a rod line running through tubing to a bull ring connecting lines to three wells is another.

An elongated rocker, guyed from either side to prevent side sway, is used by an operator in the Bradford field to effect a road crossing. A combination of the rocker or hold-up and overhead supports as employed by an operator in Warren County, Pennsylvania, is shown in Figures 6 and 7. Still another type, connecting an eccentric and turntable, carries parallel lines from one embankment to another over a highway near Pleasantville. Posts form an inverted V in the middle of a pond

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COSTS COME DOWN, TOO,
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2. Self-Checking H - K CLINOGRAPH (Hewitt-Kuster)

"H-K" designed for open holes only—provides permanent, accurate, photographic records of inclination and direction on paper discs five minutes after removing instruments from hole. (U. S. Patents 1,812,994; 2,027,642; 2,093,128 and others pending.)

A New Service that Saves Time and Money
CORE ORIENTATION SERVICE

Self-Checking SYFO CLINOGRAPH 3.

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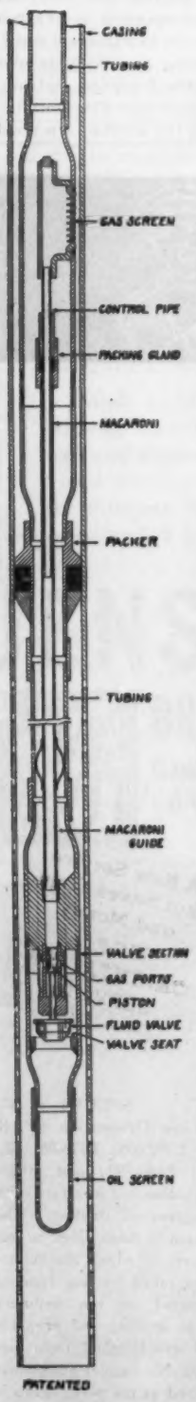

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ALHAMBRA, CALIFORNIA

on the outskirts of Titusville to carry a supporting line across a stream after the rod line had passed under a highway first and then a railroad.

A beam, pivoted at one end and the other resting on a sliding board, permitted an Oil City operator to pump a second well without altering the direction of his original rod line (Fig. 8).

A Bradford field operator has found that by

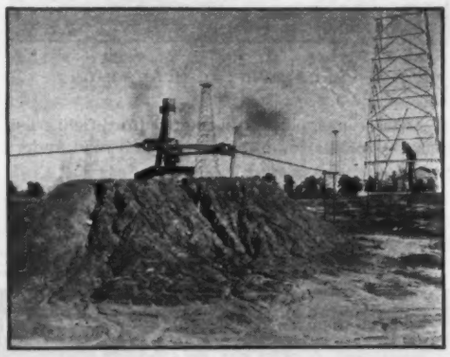


Fig. 9—Swing post on mound in East Texas

varying the angle of the swing arms to meet individual conditions, greater efficiency is obtained. This operator makes all of his own swings and all are of welded construction.

Double swings operating from a single post are occasionally required in the Bradford field where numerous rod lines emanate from a single power. In one instance the swing consists merely of a length of pipe operating from the bearing on the post. Multiple sliding boards support the end of the pipe opposite the post.

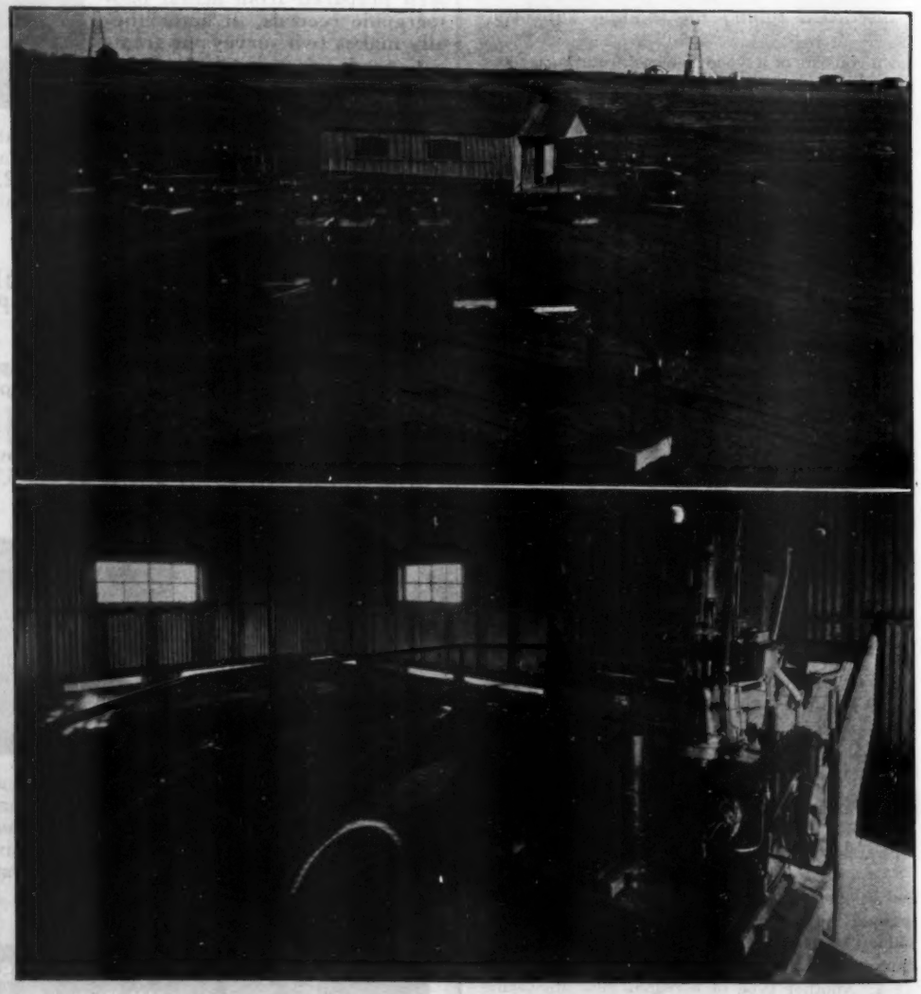
The frame of a discarded power and a wheel

Fig. 10—Two-well counterbalance. Well on right pumps a 9-bbl. producer; the other pumps a water well supplying power plant. They operate from opposite ends of a common swing

with the rod lines attached to rim of the wheel constitute an original swing on a lease at Colorado in Warren County, Pennsylvania.

To eliminate the installation of hold-downs and other rod-line equipment, an operator in the East Texas field has constructed a large earthen mound in which to install a horizontal swing (Fig. 9), thereby reducing costs. The mound is high enough that the plane of the swing is the same as that of the take-off block.

A 270-degree angle swing is employed by another East Texas operator on a backside crank



Exterior and interior of 16-well gas engine driven geared central power. Note elevated lines and method of changing direction on lines in the foreground. Also note the compactness of interior equipment

arrangement. This swing permits four wells to be pumped alternately from a conventional two-well hookup. After the diagonal well has made its production, first one and then the other of the two extending off at an angle are hooked on until they have made their production when the fourth well is put to pumping.

No more practical counterbalance can be found than that employed by an operator near Rouseville, Pa., who has an oil well and a water well, located only a few feet apart, pumping from the opposing arms of a straight-arm swing. In this unit (Fig. 10) one jack is on the upstroke and the other on the downstroke. Old equipment and rocks are often used as counterbalances on Pennsylvania properties.

A Chase, Kans., field operator has a counterbalance similar in some respects to the one first described in the foregoing paragraph. A water well is pumped by means of a wire line attached to the beam of the jack on the oil well. The line is attached to the beam with an eyebolt that can be set at several points to control the length of the stroke. From the beam the line runs through a sheave attached to the base of the jack and thence to the water well jack.

Another unusual counterbalance is to be found near Wewoka, Okla., where an operator is using a junked boiler for this purpose. The boiler swings on a pipe working in U-bolts set in a concrete foundation. Rocks are piled into the boiler to adjust the weight to the pull of the rods.

In several localities where pumping loads are heavy, old drums filled with concrete are used as counterbalances. Two pieces of discarded pipe extend from the jack and are spaced far enough apart to allow the drum to rest between them.

An operator in the Bradford field identifies each well with a number. Corresponding numbers are placed on multipliers for immediate identification of the rod lines.

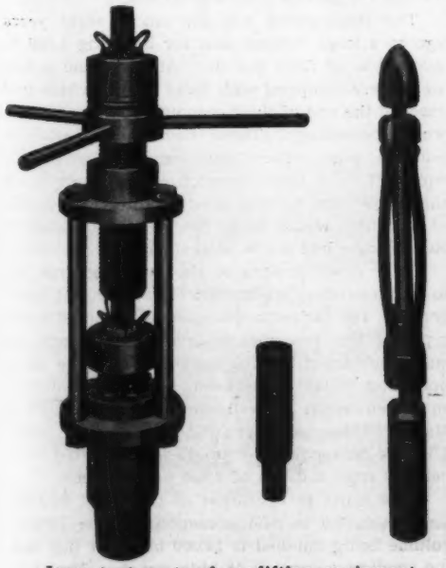
This article only briefly covers different rod-line appurtenances for innovations are almost as numerous as producers. A complete article would require years of preparation.

Gas-lift Device Developed for Low Pressure Conditions

A new oil well flowing device has recently been developed for producing oil where the pressure has dropped to the point where the desired amount of fluid cannot be produced without artificial lifting. This device is put on the market by the Acme Gas Lift Co., Houston, Tex.

In the installation of this device it is neither necessary to disturb the christmas tree nor to erect a derrick over the well. Ease of installation can be recognized when it is seen that it consists of running a string of one-inch seamless pipe in the tubing and anchoring at the desired depth by means of a slip anchor at the bottom of the string. Just above the anchor is a perforated nipple. Valves are made up in the line, usually at 500-foot intervals, but they can be placed at any points where they may be desired. The simplicity of operation is possible because valves are opened and closed from the surface by lifting the tubing with a hand screw jack. The valve nearest the surface closes first as the tubing is lifted by the jack; other valves, located at successive stages down the pipe, close consecutively as the tubing is lifted further. Valves are opened by a reversal of the process and in reverse order.

It is not necessary to have a crew find the fluid level, for the operator simply closes one valve after another until he reaches the stage where the fluid level exists. Only small air compressors are needed because of the small space between the tubing and flow line. The manufacturer rents portable compressors and pulling machines for customers who desire them.



Important parts of gas-lifting equipment

Operation of Clark Intermitter In Oklahoma City Field

The Clark intermitter is a bottom-hole device for use with intermittent gas-lift. Its primary purpose is to keep the pressure of gas injections off the producing formation. Essentially it consists of a valve at the bottom of a long chamber and a packer which can be set at any desired depth in the casing. Ordinary gas-lift connections are used at the wellhead, and gas is introduced into the casing or tubing intermittently by means of a timing device at the surface. The device has been used in more than 200 Oklahoma City wells.

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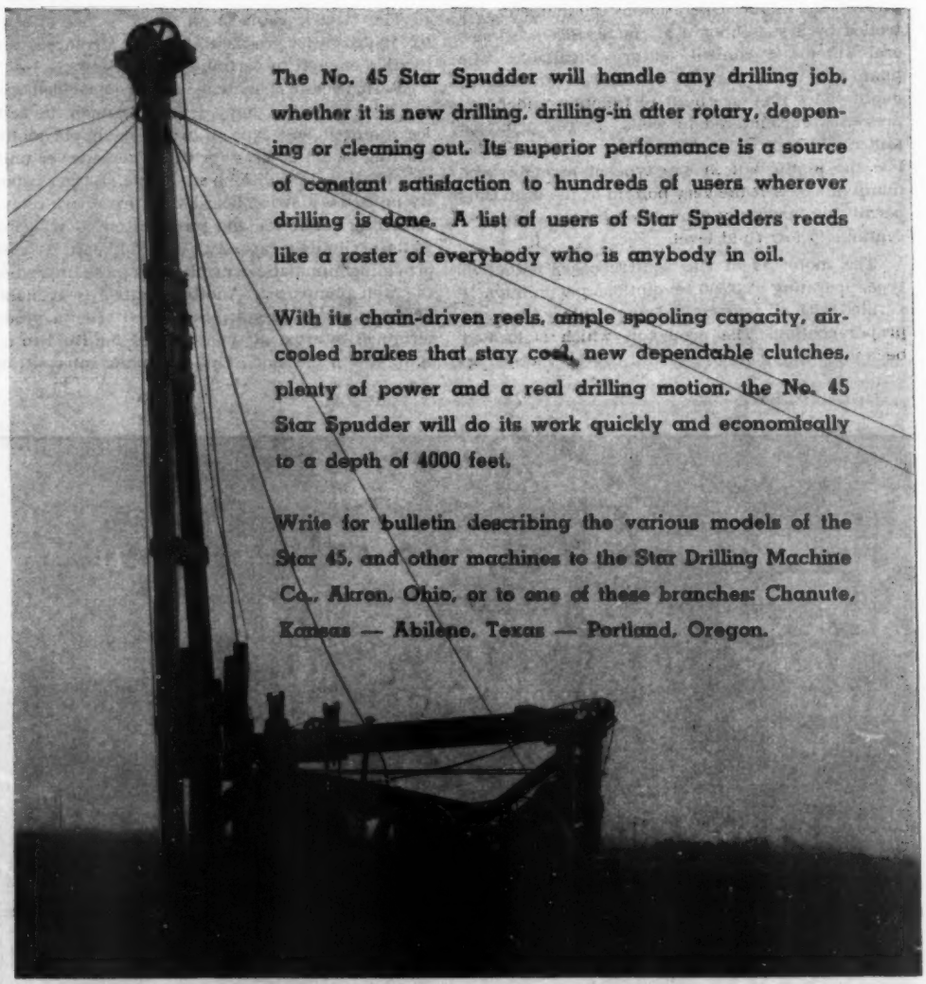

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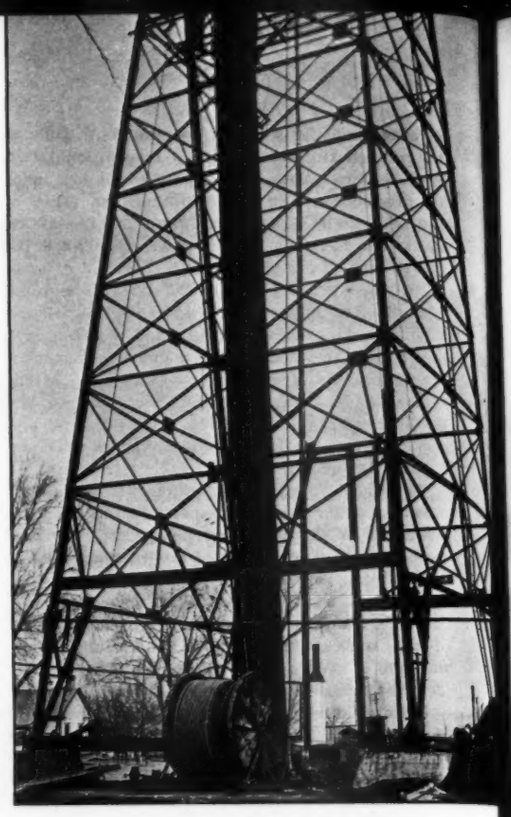
★ *For All Around Satisfactory Performance* ★

Necessity to Remove Great Volume Favors Use of Reda Pump



Reda pump hanging over well. Note reel of electric cable in foreground

Because of its nature, the construction of the Reda submergible pumping unit is not as well known as its application. Essentially, the unit consists of a multistage centrifugal pump with the shaft connected directly to an electric motor through a protector section. The entire assembly is of small outside diameter so that it can be run to the bottom of wells complete with standard sizes of casing. In the operating position the assembly is suspended on standard tubing, submerged in the fluid of the well, with a cable extending to the surface through which electricity is supplied to the motor. Operation of the motor is controlled by a switchboard at the surface with several automatic control features available. The pump and motor may be installed at any desired depth, since they are built to function under any pressures encountered in wells. In the principal unit manufactured, the Reda motor is located below the pump, but in one type of assembly the pump intake is at the very bottom of the unit, thus permitting maximum production from wells of exceptionally low fluid level.

The motor is of the squirrel-cage, induction type, operating at 3,600 revolutions per minute. It is filled with oil to insure adequate lubrication and proper cooling. The protector, which is located between the motor and pump, contains a spring-backed piston, grease chamber and an oil chamber. Its purpose is to equalize the internal and external pressures and to exclude well fluid from the motor.

The pump is a vertical assembly of centrifugal impellers and diffusers which are enclosed in a steel housing, their number, type and size being determined by the volume of fluid to be produced and the required discharge head. In effect, the entire assembly has only one straight line rotating part, with no gears, valves, or reciprocating parts and is self-lubricated.

The electric cable is oil proof, is not effected by hydrostatic pressure, is steel armored, and flexible enough to permit easy spooling.

Various control switchboards are provided with the Reda pumping units, depending upon the service required and type of well. A simple motor-starting switch is used for small horsepower units or where well conditions are stable. Larger capacity units use a switchboard with protective relays, recording ammeters and push-button control. For wells of limited capacity, a switchboard is used providing automatic controls to stop the unit when the well pumps off. Another control is available to automatically restart the pump after a predetermined interval of time allowed for fluid to accumulate in the hole. This automatic intermitting insures maximum production from wells of this type, the shutdown being made only when the wells pump off.

The installation of the Reda pump consists of lowering the motor, protector and pump assembly into the well on the tubing in a manner similar to a working barrel, the cable being supported by clamping to the tubing at intervals. The surface end of the cable is attached to the switchboard and the pump is then ready to operate. Since there are no moving parts aboveground, no foundations are required and the item of setting time and expense, required with many types of pumping equipment, is eliminated.

An interesting fact, resulting from this absence of surface equipment, is that "seagoing" locations or locations subject to surface flooding need no other foundations than those sufficient for the derrick itself. While there are no instances known where there have been Reda installations in wells drilled in bodies of water, there have been instances where Reda-equipped wells have continued to produce for the duration of floods which submerged the derrick floor several feet.

The Reda pump was introduced eight years ago as a large volume unit for handling 1,000 to 2,000 bbls. of fluid per day. At that time a few wells were equipped with Reda pumps which had reached the end of their economic life due to high water percentage. These had been previously pumped with other equipment. These Reda-equipped wells have operated continuously since then, producing several hundred thousand barrels of oil which would never have been recovered if Reda pumps had not been available.

Later developments of the pumping unit led to its economical application to smaller and deeper wells. The earliest applications supplanted other types of less powerful equipment, and such installations are still being made. Most of the units operating today have been installed as initial equipment when the wells first required pumping. Many of these have been the smaller sized units, 7.5 to 14 horsepower for producing 20 to 100 bbls. per day from a depth of 2,500 to 4,200 feet.

Reda units in operation at this time include sizes from 7.5 to 97.5 horsepower. The largest volume being handled is 14,000 bbls. per day and the smallest volume is 18 bbls. per day. The shal-

Electric-generating unit powered by diesel. Unit supplies power to pump wells in the Nocona, Texas, area

lowest setting is 375 feet below the surface and the deepest is 7,300 feet, although deeper applications are possible.

The flexibility of application of this type of equipment and the exceedingly wide range of capacities available have naturally brought about the use of this type of pump to meet many unusual conditions as well as the ordinary oil well pumping conditions. Many wells, too crooked to permit the use of sucker-rod or shaft-driven pumps, have been profitably produced with Reda pumps. Isolated wells of too limited capacity to support the expense of a pumper have been operated profitably with automatic Reda pumping units. Mine dewatering has been carried out with Reda pumping units. Fresh water wells are being pumped with this equipment and chemical brine wells are being produced with Reda pumps.

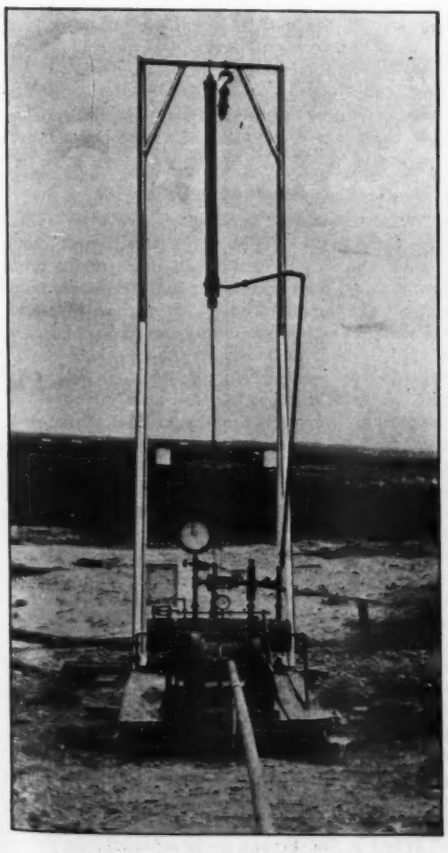
Although Reda units are perhaps better known in areas where large production of fluid is required, small production is being handled economically with the smaller sized Reda units. It may be remarked that deep well applications of Reda pumps have been more prominent than the equally important shallower well installations which have not been conspicuous.

In wells capable of greater output than is obtainable with the most powerful Reda unit, the Reda gas-lift combination has been used where there is a high-pressure gas supply. This unit is a production device developed especially for wells of high productivity with comparatively low formation pressures. In this method, gas-lift is used to reduce discharge pressure on the pump, thereby permitting the pump to handle a greater volume of fluid. A packer is run on the tubing to pack off the annular space between casing and tubing. This is usually set about 300 feet above the pump. Discharge ports located just above the packer offer a passage from the inside of the tubing to the annular space. High-pressure gas is introduced into the tubing at the surface. The oil from the pump and the gas from the surface pass through the discharge port together and proceed to the surface through the annulus. In this way the column of oil above the packer becomes aerated and exerts less hydrostatic pressure on the pump discharge. The effectiveness of the combination is brought out by a 6,500-foot Oklahoma City well which produced 500 bbls. per day by straight gas-lift, 1,200 bbls. per day with unaided Reda unit, and 5,000 bbls. per day with combination assembly.

The development of the Reda pump during the past eight years has made it an exceedingly versatile pumping method, individual well problems being solved with a unit suited to that particular well. Changing well conditions can be met with comparatively minor alterations in the unit, and consequent savings on investment.

System for Application of Surface Control to Gas Lift

The Nixon Surface Control Gas-Lift System is installed in more than 160 wells in various fields, principally in Southwest Texas and on the Gulf Coast. It is reported that this system has effected considerable reduction in the down time of wells; one operator using 54 of these installations reports that down time has been cut to 1.94 per cent. This system is automatically controlled from the surface. A series of valves is set at regular intervals in the tubing. Gas under pressure is introduced into the annular space between the tubing and the casing; on the opening of the surface-control valve, actuated by a weight bar, gas is injected into tubing. Working pressure is determined under conditions of natural flow and by the amount of fluid which is to be raised. Wilson Supply Co., Houston, Tex., is the exclusive agent.



Control equipment for gas-lift

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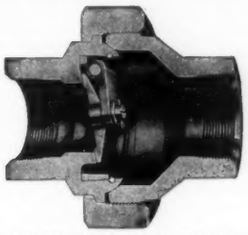
Single Union Swing Check Valves —For 250 pounds working steam pressure—400 pounds oil, water and gas pressure. Tested to 1,000 lbs. non-shock hydrostatic pressure. Sizes ¾" to 3".

Catawissa Forged Steel Standard Unions, ball to angle seat, the most efficient and economical union for general service.



No. 600—Pipe Union type for high pressure boiler feed lines and heavy duty service. For 600 lbs. W.S.P. and 1500 lbs. O.W.G. Made entirely of FORGED STEEL with stainless steel flapper. Opening the union nut opens the line, eliminating the necessity of an additional union and nipple. Made in 2" size only.

No. 350—Same type construction as above except valve body is Refax metal and flapper is of Hitensiloy. For 350 lbs. W.S.P. and 750 lbs. O.W.G.

Double Union Swing Check Valves —For 250 pounds working steam pressure — 400 pounds oil, water and gas pressure. Tested to 1,000 lbs. non-shock hydrostatic pressure. Sizes ¾" to 3". This valve eliminates an additional union and nipple either in the outlet or the inlet end of the line. Specially adapted for OIL FLOW LINES.

Catawissa Swing Check Valves are more economical and efficient than the check valve assembly you are now using. Ask for Bulletin 7

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WELL REGULATED

Here a Chaplin-Fulton High-Pressure Regulator and a C-F Low-Pressure Regulator with automatic cut-off are seen on the fuel line of a 400-h.p. gas engine used by a leading oil company in Kansas.

Chaplin-Fulton pressure-control devices for all uses have been standard equipment in the oil and gas industry for over fifty years. Ask for catalog.

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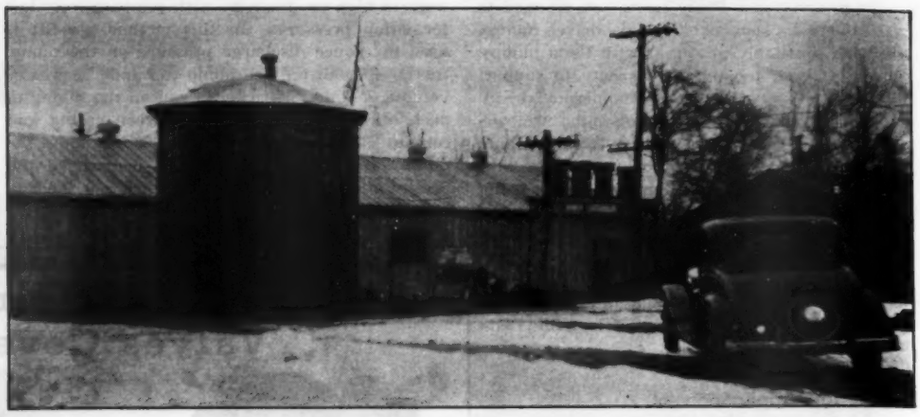
Pumping Practices Followed in Eastern Oil Fields



Centrally located power house and water plant, usually found on larger leases in the water-flooding area of the Bradford field of Pennsylvania

Lifting oil from the producing sands of the Eastern fields is probably more varied than in any field in the rest of the world. Over the areas of New York, Pennsylvania, and Ohio is found equipment which differs greatly in operations, yet in the end it places the oil in storage for pipe line transportation. In the Eastern fields today one can see all types of equipment from the early-day method of pumping by walkingbeam and steam engine, down to the latest electrically operated individual pumping-jack. The operations, surface conditions and amount of production are largely responsible for the equipment in use in every locality.

The highest efficiency of pumping oil from the wells has been developed in the Bradford, Pa., and Allegheny, N. Y., fields. Here every known detail for elimination of friction and unnecessary loss of power can be found in operation. Slippage between engine and powers is overcome by use of proper width belting, raw-hide reenforced. Ball-bearing powers are used with A-rocker standards carrying the rod-line to the pumping jack. At the angle of a drop or rise in the ground the rod-line is supported by a hold-up or a hold-down standard which works in bearings and keeps the rod-line running in almost a straight line.

Bandwheel Powers

Here, too, will be found the bandwheel power turning on the latest type of bearings and an oil pump bath is used to insure elimination of friction and wear. As the power takeoff pull-rods emerge from the power house there will also be found details worked out for any loss of stroke which might be lost in unnecessary angles. In the pumping units of the water-flooding area of the Eastern fields will be found methods proven by years of experimenting, the one aim being the lowering of lifting cost per barrel of oil.

Then there are the fields where production has, through the loss of sand pressure, fallen to a state where wells are only pumped once every 30 days. Some of these wells have but a few barrels of production a year, and over these old wells, which average over 2,000 feet deep, will be found the remains of the old standard derricks erected years ago when production made these booming fields. Time has almost erased the standard derrick which used to dot the hillsides of the fields, and the old familiar crown block emerging from the wooded hills is a rarity now. Most of the equipment now used for conditioning or renewing of pumping equipment consists of a portable pulling pole, operated by a tractor. But in many places iron pipe masts and wooden poles are permanently set over the wells.

Here also will be found the old type pinion power which first came into use when gas from the wells became exhausted and pumping could no longer be carried on by steam. These powers took the place of the steam-operated walking-beam pumping unit, using rod-lines suspended by tripods and pendulum hangers which had to be renewed from time to time. Eventually the push-and-pull power came into use and today hundreds of these old foundations dot the hillsides throughout the eastern fields. Gas engines soon replace the steam engine and boiler. Many of these steam engines were converted to gas engines by the changing of the steam cylinder to one designed for internal combustion of gas and using the steam engine bed, crankshaft and fly wheels.

As time and methods of introducing water into the oil-bearing sands to stimulate increased production proceeded, the earlier methods of pumping gave way to new and efficient machinery. Every factor where loss of power could be overcome has been worked out to a minimum.

Today two kinds of pumping units are found to be the most practical and efficient for lifting oil from the producing formations. First, the gas engine or electrically-operated bandwheel power; and second, the individual electric pumping jack. In localities where the ground surface is not too irregular the bandwheel power is most widely used. Only one operation of early day method of lifting oil from the sands remains in these fields, that is the same operation of the working barrel and use of valves.

Permanent Units

Where increased production has been raised to a point of 24-hour pumping and is continuous throughout the life of the well, many of the units are installed on a permanent basis. Concrete foundations are built and where swings are necessary for road or highway crossings, stroke posts made of pipe casing or hardwood timbers are set in bearings on concrete foundations. A secondary line is used at these crossings to care for the support of the main rod-line in case of a break so as to protect the roads and highways. The rod-lines are of the clam-shell type, supported at the coupling by a set of A-rockers.

The rocker consists of two stakes driven into the ground directly beneath the middle point of travel of the rod-line. Through the top of the stakes, and at an even level, holes are bored. In the set of legs used to reach the rod-line are also a set of holes put at an angle so the tops will come together. Through the stakes and legs is placed a rod of sufficient length to allow for bending outside the stakes to prevent them from coming out. The tops of the legs are cut at a point so no sag can come in the rod-line. A one-half inch bolt of proper length is put in the eye of the clam shell, then a board is nailed about midway between the top and bottom of the A-rocker.

When a line breaks or is separated very few of these rockers are upset or fall over, as is the

Repressuring is an important operation in obtaining the highest ultimate recovery of oil from a given area. Above is shown the interior of a modern repressuring plant

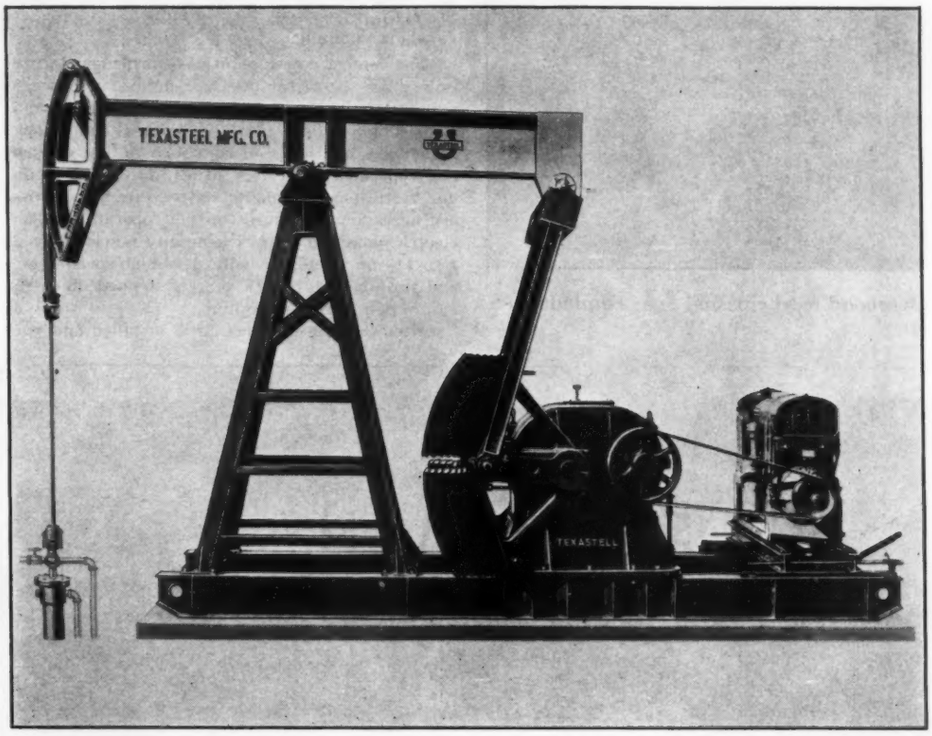
case when tripods are used. This is especially true when the rod-line is over a steep hill and travel of the rod-line is almost without friction.

In some places where owing to short lines the cost of installation is a deciding factor, two-inch pipe is driven into the ground. A hardwood head with a deep groove cut to guide the rod-line is placed in the pipe. This makes a very good and inexpensive installation, but rainy and freezing weather soon leaves the heads dry. The loss of power consumed by friction in many cases is far more than the actual lift of the pumping jack on the rod-line. Where 30 or more wells are on one power the wasted energy would be far in excess of several pumping wells. Therefore, in a large development this type of rod-line support is not used much. The lines are often removed from the support and dragged on the ground, but this soon wears the line in two, so that in most cases it is found very unsatisfactory.

When swings are used, one of the most efficiently constructed is made by inserting one piece of casing inside another with just enough room between them so they will turn freely. The bottom end of the outside casing is closed by welding in a round piece. The smaller pipe is placed inside the larger and at the top of the outside piece of casing is placed a thread protector welded to the inner pipe. Therefore when oil is poured into the inside pipe it is sealed in and the swing is continuously running in oil. A cross arm inserted through the top of the inside pipe permits the desired connections for the rod-line take-offs to be made. This type of swing, if kept filled with oil, will give long wear and trouble-free operation.

Electric Operations

Some of the large operators in the flood district find electricity more adapted to their operations than the bandwheel powers, since in most cases the ground is uneven and broken in many places by deep valleys. Therefore some operators construct a central power-house where either gas or diesel engines, directly driven to electric generators, produce the power which is carried over



Rigidity is provided in this compact pumping unit by the electrically welded four-legged sampson post constructed of heavy angle irons onto which a steel head is welded. The base consists of heavy structural sills reinforced by cross members, all electrically welded

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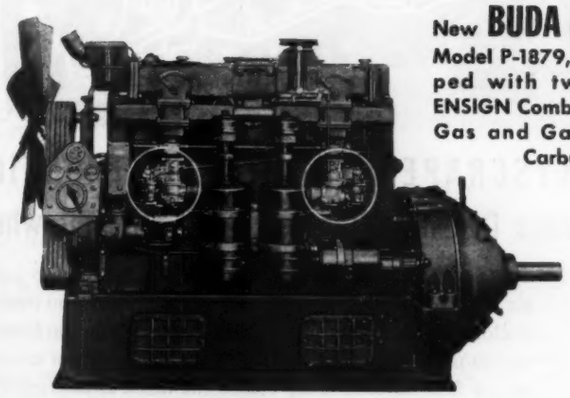

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Overhead road crossing near Fagundus, Pa.

the producing lease by means of a transmission system and delivered to the well location where a single pumping unit is installed. Many of these wells are not operated fully 24 hours a day, but are operated by a time clock and are pumped more by heads than by continuous stripping or constant pumping.

The central power plant also furnishes electric power for the water pressure pumps, which are usually of the direct-driven centrifugal type, and also supplies light for the houses and shops which are on the property. Most of the electrically operated properties install four- or six-cylinder vertical power plants and two or three units are necessary to insure constant operations. The electric pumping unit is generally powered by a 1 to 1½ hp. motor, usually of a high-speed type, and through an oil-bath gear is stepped down to 18 or more strokes a minute.

After the line has once been installed and put in operation this kind of pumping equipment is practically free of upkeep and is most efficient in operation. Each well can be timed to its individual needs. The erection of poles and the stringing of electric wires is much faster than the usual rod-line installation over such rough ground. The wires can be carried through the wooded sections much more easily than where rod-lines must be built so as to radiate from one

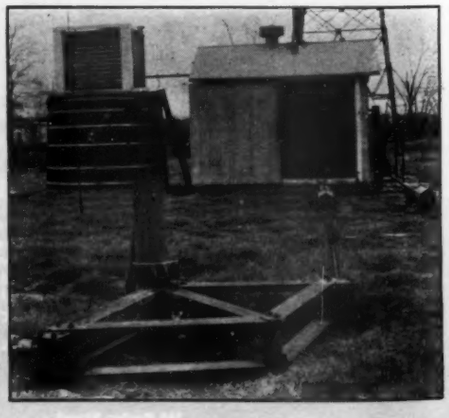
Electrically driven jack pumping from a depth of about 1,200 feet

given center. The cost of operating these electric jacks is not more than a few cents a day.

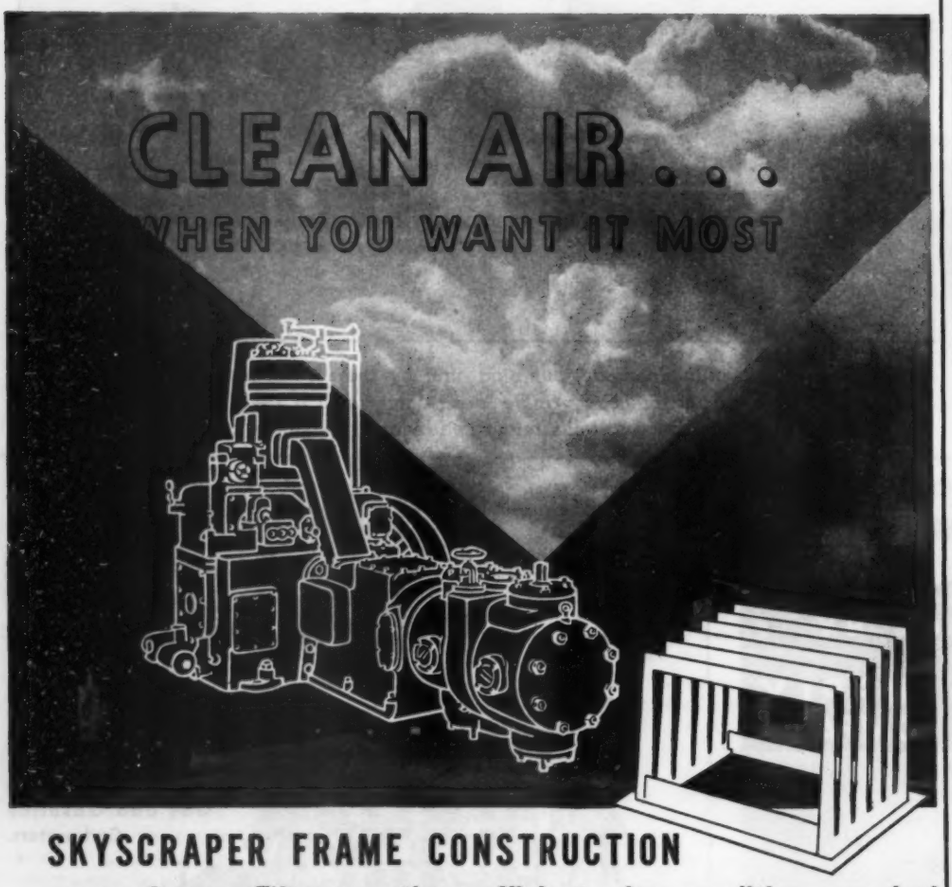
On oil producing properties where electricity is purchased from utility companies, the power line is built by the company, and also usually the transformers used to cut down the high voltage to the ordinary 220 or 110 volt current. From here the operator extends his own lines and whatever equipment is necessary for proper distribution over the property. Where electric power is purchased for pumping the average cost will only amount to a small part of the production. In many cases wells operating at the depth of 1,400 feet can be operated by this method for as little as 30 cents over a 24-hour period.

Working Barrel Equipment

Two-inch standard tubing is used almost exclusively in the pumping wells in the Eastern fields. The plunger-type working barrel has been



Large angle swing and safety throwoffs on back crank installation in East Texas



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Here's the speed and flexibility to handle a larger variety of oil field jobs and do more of them per year; here's the strength and stamina that slashes operating and maintenance costs to new lows. That's what you get with the Model 255 — and that's why it will pay you to investigate it without delay. Send today for Bulletin X-42 — it tells you exactly why the 255 is *five years* ahead of the field! Address the Harnischfeger Corporation, 4527 West National Avenue, Milwaukee, Wisconsin.

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Typical long-stroke pumping unit in the Edmond field of Oklahoma

found to give the longest life. These working barrels will pump floating sand without giving any great amount of trouble, and on continuous 24-hour pumping will operate successfully for months at a time without attention. An extension is usually placed on the lower part of the working barrel so that the standing valve will permit the plunger to travel the entire length of the barrel and keep free any corrosion which might otherwise stick or foul the plunger. This type of installation in wells has been known to run for several years without any adjustment or reconditioning of the barrel and valves. Many of these pumping wells will produce more than 200 bbls. of fluid in 24 hours. When the great amount of fluid passing through the working barrel is taken into consideration and also that the water contains many harmful elements, it will be realized how efficient this type of working barrel really is.

The canvas, leather and composition cup is most used on pumping wells in this area. Where wells are daily or weekly pumpers the leather cup is the most commonly used. The reason for this is because of the very little sand action on the cups or the working barrel, and throughout the natural producing area of the field this equipment is still the dominant factor in pumping oil.

A now obsolete type pumping unit can still be seen in a few places. That is the old style air-head unit which was placed directly over the casing head, and connected to the polish-rod by a method of clamping the polish-rod to the traveling cylinder of the air-head. This pumping arrangement was operated by compressed air obtained from a central compressing station and in most cases used the old steam lines to transport the air to the well from the plant. These units operated very successfully, and were proclaimed the last word in pumping economy when they came into use. A few of this type still remain in a scattered area of the Eastern fields where small stripping wells still exist.

Probably as much change in motive power as in pumping power is responsible for the low cost of producing oil from the wells. The introduction of diesels and other type fuel oil engines, which could be operated over long periods without much attention and a very low cost of upkeep, have made it possible for 24-hour pumping to be carried on with only one operator.

Forced-feed oiling systems and use of roller bearings insure good operation of this type of power unit. These engines are also used in driving water pumps where water has been introduced into the sand for flooding purposes. The average oil consumption for 24 hours would not exceed 50 gallons. Another method of gaining power is to install a counter-shaft pulley horizontally on a concrete block midway between the engine and bandwheel power. This also gives a tighter driving tension on the belt.

The engines are usually of about 40 hp. rating, of either the gas or fuel oil type. The standard bandwheel power is 24 feet in diameter, and of the double-eccentric type with a 36-inch stroke. The oil pump is arranged so as to eliminate shutdowns for oiling and will operate continuously for many months without attention.

Production of Wells

It would be hard to determine what average amount of oil each well will produce daily, but it is reasonably close to place it at about 15 wells to one barrel of oil throughout the producing areas of the Eastern fields. In the water-flooding area the daily average is probably nearer to 18 bbls. per well while some of the flush wells will produce from 50 to 80 bbls. the first few days after completion. Wells on blocks that have been under flood a number of years seldom average more than four or five barrels a day and these wells pump on an average of 10 bbls. of water to one of oil.

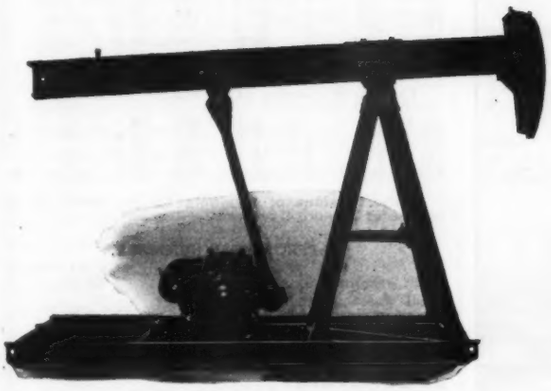
The Oklahoma-type pumping jack set on either wood or pipe foundation is the standard equipment for rod-line installations and the enclosed gear box, with a single pitman to the beam, is most used where electric power is supplied.

Still Gushers

Strange as it may seem in this field, where in August, 1859, the oil industry was born and that throughout the years fields have come and gone, some even forgotten, is that the Eastern fields have from time to time aroused new excitement by bringing in a new gusher. Today located 10 miles south of Bradford, Pa., are several new gushers. The largest one of these wells discovered was brought in during the summer of 1937, making 200 bbls. an hour on its initial flow. So as we bring to a close this article on pumping conditions in the Eastern fields, we still find new gusher pools being developed.

Compact, heavy-duty geared unit in Talco, Texas, field

HERE ARE
3 NEW REID
PRODUCTS



Reid UP-10 Pumping Unit.

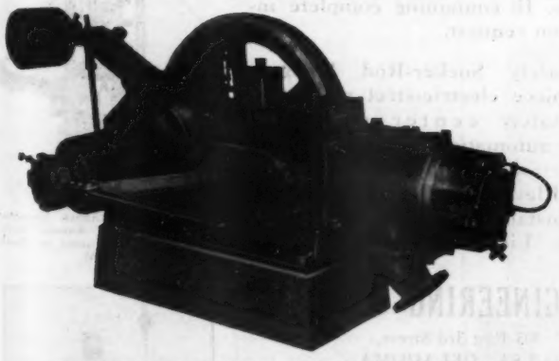
UP-10 PUMPING UNIT

The Reid Type UP-10 Pumping Unit is of the single crank, beam balanced type, rated 10 HP at 20 strokes per minute, with a maximum polished rod load of 10,000 pounds and 37-inch stroke. Careful design and construction combine to produce a rugged and efficient pumping unit, with particular care taken to provide proper bearings and adequate lubrication for the bearings. One important feature is the mounting of the counterweights, which are equipped with handles and individually clamped to the beam, a construction which makes it safer and easier to remove and add weights. Detailed information will be furnished upon request.

Reid PE-3 Geared Power.

PE-3 GEARED POWER

The Reid Type PE-3 Geared Pumping Power is rated 30 HP at 20 strokes per minute. It is Dust-Tight and Oil-Tight which means it may be set in the open. Simple in design, it is easily accessible for inspection, and the cover may be removed without disturbing shafts or gears. It is completely Timken Bearing Equipped. Gear ratio is 25 to 1, with wide faced, helical, cut steel gears in both first and second reductions. Ample provision for lubrication is assured with the combination splash and mechanical circulating systems. Ask for Bulletin No. 72.



Reid "Terrier" 7½" x 9" Single Cylinder Gas Engine.

THE REID "TERRIER"

7½ × 9" GAS ENGINE

The Reid "Terrier" 7½ x 9" Single Cylinder Horizontal Gas Engines, rated 14 HP at 250 rpm to 30 HP at 550 rpm for continuous operation, has been developed particularly for single well units. This engine is modern in every respect, has Timken Main Bearings, and includes many features of design incorporated in all Reid Engines. Controls are conveniently mounted in one assembly and all are readily accessible. It is entirely enclosed, dust-proof and oil-tight, and flexible and dependable in operation.

The application of the Reid Take-off, with built-in cone clutch, and fitted with either V-belt or flat-belt pulley, is easily made. Its use, together with the bed idler, permits the use of the engine on units where short centers are desirable. Complete detailed information will be furnished upon request.

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Crudes From Pennsylvania And New York Analyzed

Petroleum produced from different oil fields in Pennsylvania and New York is similar in character and uniform in quality, according to a survey by the Bureau of Mines. This similarity exists regardless of geographical distribution of the fields, depth of wells, date of collection of the samples, or method by which the oil was produced. Samples were taken from properties where no secondary recovery practices have been employed as well as from properties where stimulative production methods were used, such as water-flooding and repressuring. Samples of oils from fields in Venango County, Pennsylvania, appear to be lower in gasoline content than the others.

The bureau has collected and analyzed a series of crude oil samples from oil fields of Pennsylvania and New York during the past 19 years, the first sample having been taken in February, 1919. All the samples were analyzed by the Hempel method, which is described in Bureau of Mines Bulletin 207, "The Analytical Distillation of Petroleum and Its Products," by E. W. Dean and others.

Details of this survey are in preparation for early publication as a report of investigations which will include analyses of 58 crude oil samples collected within the Pennsylvania-New York area. Copies will be available upon request to the Information Division, Bureau of Mines, Washington, D. C.

The analysis of a sample from a well producing from the Bradford third sand, Bradford field, McKean County, Pennsylvania, which is representative of the Pennsylvania and New York oils, gave the following data:

GENERAL CHARACTERISTICS

Specific gravity	0.800
Sulfur, per cent	0.11
Saybolt Universal viscosity at 100° F., sec.	39
A.P.I. gravity, deg.	45.4
Color	green

DISTILLATION, BUREAU OF MINES HEMPEL METHOD

Dry distillation Barometer 738 mm. First drp: 32° C. (90° F.)

Temp., °C.	% cut	Sum, %	Sp. gr. of cut	°A.P.I. of cut	Visc. at 100°F.	Cloud test, °F.
Up to 50	2.1	2.1	0.650	86.2	...	...
50 to 75	4.1	6.2	.664	81.6	...	...
75 to 100	5.0	11.2	.693	72.7	...	...
100 to 125	6.7	17.9	.728	62.9	...	...
125 to 150	5.9	23.8	.749	57.4	...	...
150 to 175	5.7	29.5	.764	53.7	...	...
175 to 200	4.7	34.2	.774	51.3	...	...
200 to 225	5.7	39.9	.786	48.5	...	...
225 to 250	5.4	45.3	.798	45.8	...	...
250 to 275	5.9	51.2	.811	43.0	...	...
Vacuum distillation at 40 mm.:						
Up to 200	4.1	4.1	0.835	38.0	41	30
200 to 225	4.9	9.0	.837	37.6	45	40
225 to 250	5.7	14.7	.850	35.0	54	65
250 to 275	4.4	19.1	.868	31.5	75	75
275 to 300	6.4	25.5	.874	30.4	115	90

Carbon residue of residuum 1.9 per cent; carbon residue of crude 0.4 per cent.

APPROXIMATE SUMMARY

	Per cent	Sp. gr.	°A.P.I.	Visc.
Light gasoline	11.2	0.674	78.4	.....
Total gasoline and and naphtha	34.2	0.726	63.4	.....
Kerosene distillate	17.0	.798	45.8	.....
Gas oil	9.6	.839	37.2	.....
Nonviscous lubricating distillate	10.7	.844–.872	36.2–30.8	50–100
Medium lubricating distillate	5.2	.872–.877	30.8–29.9	100–200
Viscous lubricating distillate	...	...	....	Abv.100
Residuum	21.3	.895	26.6	.....
Distillation loss	20.0	....	....	.....

High-capacity pumping unit used to take potentials on wells in the Hauschild pool, Kansas

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are ready to serve you overnight. Send us your water problems, sample of water, or if you want to know more about the Haering Products and what they have done for other refineries, write for our booklet "Organic Methods of Scale and Corrosion Control."

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SHOCK ABSORBERS SUCKER-ROD HANGERS

TECO Shock Absorbers reduce Sucker-Rod wear and fatigue caused by shock loads and vibration, and improve sucker-rod performance. This has been proven by many tests. They will protect your rods from unnecessary wear. Our new catalog No. 10 containing complete information on request.

TECO Safety Sucker-Rod Hangers have one-piece electric-steel rack with patented safety center guide-tooth. Winch has automatic or manual control brake. Furnished with plain or Safety Transfer Elevators. Portable or permanently installed types. A full line of accessories. Literature on request.

THE ENGINEERING COMPANY
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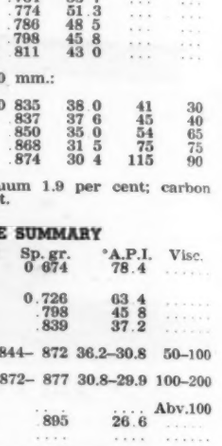
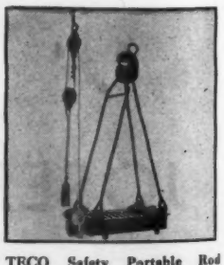
TECO Pull-Rod Shock Absorber used on Rod Lines to Protect Geared Powers from Shock loads.



Triple No. 8 TECO Shock Absorber on a 6500-foot Oklahoma City well.

TECO Tandem Shock Absorber used on heavy Kansas wells during potential tests at 35-40 S.P.M.



TECO Safety Portable Rod Hanger, with Automatic Brake-controlled Winch, Safety Transfer-Elevator, Bails, and Safety Hook.

HYDRAULIC PUMPS

(Continued from Page 84)

The production curve is given in average barrels per well per day, per month and is on a steady increase which corresponds to the decline of the down time curve. This fact is quite evident for as the down time decreases, the production will naturally increase.

The upper curve is the average barrels per hour for the hours pumped. The reason for the little variation in this curve is because of the fact that it does not take into consideration those hours when the pump was not in operation. The slight decrease in January is the result of slowing down of some of the pumps due to the cut in allowables.

Survey of Pump Operations

Probably the most important question confronting the operators as to hydraulic pumps, is that of the length of run of the pump after it is installed. The past experience has been summarized on 22 wells operated by the company to which the company is affiliated, in the north end of the Oklahoma City field, which covers an approximate five months operation per well. This tabulation and summary is found in Table 1. As can be seen from the above mentioned table, the worst feature to be encountered is that of the high per cent of pumps that would not start after installation. The reason for this can be divided into two separate classifications. First, mechanical failure. This has been greatly improved by the study and analysis of these failures and at the present time it is the author's opinion that the majority of these difficulties have been overcome. The second reason is that of dirt. This has largely come as the result of dirty tubing, both of surface dirt and mill scale, and that of corrosion of the tubing resulting from exposure to water. Of course, the dirt in the tubing can be met with under ordinary conditions, but crews running pumps under severe weather conditions have, in the past, been hard to train and made to realize the importance of keeping all surface dirt away from the tubing and pumps during installation. To meet with the corrosion and mill scale, the tubing has been sand blasted and in the majority of cases good results have been obtained.

It has been observed that the first two months a well operates on hydraulic pump, in most cases the recovery per pump is much smaller than in the third and fourth months. When a pump is first run, it is necessary to determine what speed and operating conditions are most suitable for the individual well. It was further noted that when a new installation was run, better results were obtained where the pump was started out at a slow speed and gradually, covering a considerable period, the pump was speeded up until the desired operating speed was obtained. This, of course, has resulted in most operators going to gas engine drives to take advantage of the variable speed conditions. However, this can be done to some extent by means of changing piston and liner sizes in the triplex pump in the electric drive units. This operation can be done in approximately one hour, but the speed variation is not a gradual increase and, therefore, cannot be controlled as in the case of the gas engine drive.

To further study this problem, Table 3 was prepared to show that there has been a decided improvement over the life of these installations. This table was compiled on all installations in the Oklahoma City field and shows that, by close study of pumping problems by the operator, and by the manufacturer, the results have been favorably improved, until, as can be seen from the above mentioned table, a point has been reached to where only .80 pumps per well were pulled during January, 1938.

It has been the practice of Wilcox operators to equip their wells with production methods and equipment that will not handicap them in case of widely varying allowables. Records indicate some wells of small capacity located on the edge of the field are equipped with hydraulic pumps too large for the well's potentiality. This has resulted in poor pump performance, because of the fact that the present construction and auxiliary equipment prohibits their being slowed down to a point where they will handle the well's capacity without pumping off. As can be seen from the records shown in Table 1, wells whose "average production per pump run" is low, are generally found to be wells with a correspondingly low "monthly production."

Before deciding on the size of the installation to place on a well from which the total fluid withdrawal is essential, it is to the operator's decided advantage to determine as closely as possible the ability of the well to produce, and from these data select the proper size pump for the individual well.

The following table shows the recommended sizes of pumps for production as indicated:

	Bbls./day
2-inch pump	100
2½-inch pump	200
3-inch pump	400
4-inch pump	800

The writer wishes to express his appreciation for the assistance offered by C. M. Rader of Kobe Inc.

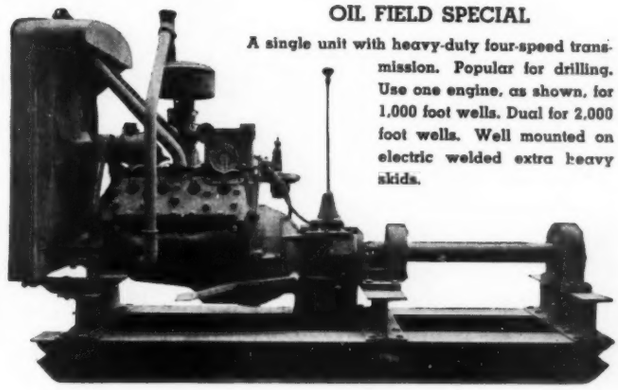
Summary

Hydraulic pumping in the Mid-Continent is still in its infancy with the exception of the Oklahoma City field where, at the present time, there are some 52 installations, consisting of one 4-inch, five 2½-inch and 46 3-inch pumps. In this field considerable time has been required to train the field personnel to the point where the pumps can be operated to the best advantage.

Hydraulic pump lifting costs have been on at least an equal basis with other pumping methods

True FORD Dependability and Economy with these General Power Units

Available in Single, Dual, and Triple engine units, these General Power Conversions of Ford V-8 Engines offer the ideal power for DRILLING, PUMPING, and GENERATING.



OIL FIELD SPECIAL

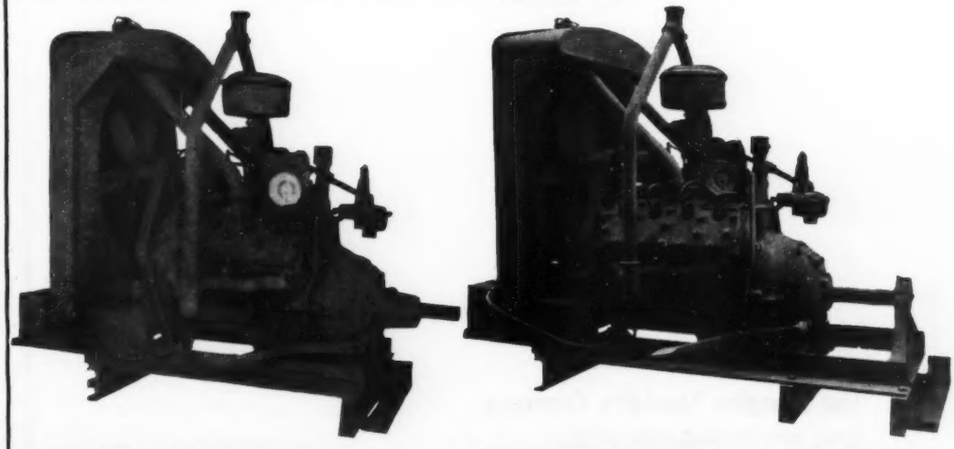
A single unit with heavy-duty four-speed transmission. Popular for drilling. Use one engine, as shown, for 1,000 foot wells. Dual for 2,000 foot wells. Well mounted on electric welded extra heavy skids.

T-B SERIES

For general power applications. Has heavy-duty clutch. Power take-off shaft mounted on twin bearings. Burns natural gas or gasoline. Series T same as above, but equipped with Twin Disc clutch and single bearing on shaft.

G SERIES

With outboard bearing for general power applications. Has large clutch. Floor space 27" wide, 61½" long. Burns natural gas or gasoline. Engine and engine parts exchange plan are available from the nation-wide Ford organization.



GENERAL POWER INC.

QUAPAW, OKLA.

and, in many cases, the last few months, have shown a decided advantage.

The cost of equipment and installation of a 3-inch pump in the Oklahoma City field, equipped with gas engine drive is approximately $11,000, including both strings of tubing.

Bibliography

1. C. J. Coberly, "Hydraulic Power Applied to Oil-Well Pumping," 1933 A.P.I. Year Book of Drilling and Production Practices. 2. B. M. Moroney & F. R. Wheeler, "Oklahoma City Field Pumping," presented at A.P.I. Convention, Chicago, Illinois, November 11, 1937. 3. W. H. Stueve, "Electric Power Required for Pumping Oil Wells," September, 1937, issue of Petroleum Engineer.

MEXICAN LABOR

(Continued from Page 88)

findings even on points where errors had been proven.

Award of the Labor Board

The hearings before the Labor Board closed on October 23. Although a mandatory period of 72 hours following the filing of the written briefs is established by law for rendering of the award, the board withheld judgment for almost 60 days. This delay was the subject of bitter attacks on the part of the workers, once to the extent of declaring and effecting an illegal stoppage of work of 24 hours as a protest against the dilatory tactics of the labor authorities, despite the prompt intervention of the president who pointed out the illegality of the movement and threatened the penalties under the law.

On December 18 the representatives of capital and labor on the board were summoned by the government representative, as chairman, to "hear" the draft of award upon which they were then expected to vote. This was a violation of the law which prescribes the representatives of capital and labor shall each be handed the draft for study and the formulation of opinion three days before the voting. In this case, the draft of award was read and the voting was carried out immediately, within five or six hours.

The financial situation of the companies was adjudged extremely prosperous since the board considered they had earned over 168,000,000 pesos during the period 1934-1936, despite the books and accounting records of the companies which showed a figure of only 68,000,000. The difference was "adjusted" by the board because of alleged differences in export prices between actual invoices and trade journal quotations and because of rejection of expenditures such as income tax payments, tax charges for the exportation of capital, etc. Full responsibility for the conflict was attributed to the companies because, as alleged, they were experiencing "economic improvement" while their workers were faced by declining value of wages due to higher costs of living. Moreover, the board condemned the companies to strike pay.

The award condemned the companies to graduated salary increases averaging 26.69 per cent over 1936 rates, extensive social and economic privileges and other burdensome administrative features. The board estimated the total cost would be an annual amount of $26,339,393, or almost the exact total cost of the recommendations of the experts commission, despite the fact that the industry had repeatedly shown the actual cost to the companies would be well over 40,000,000 pesos per annum.

Statement of the Companies

So biased was the award that the oil companies were forced on December 19, following the decision, to issue a formal accusation against the illegal action of the Federal Labor Board. This statement stressed that the award was based almost exclusively upon the report of the official experts to the virtual exclusion of the proofs offered by the companies, and that the experts' report was based largely on purely arbitrary statements, unsupported by proofs, which in many respects completely ignored elementary economics and recognized practices of accountancy.

Some of the salient provisions of the award are summarized: Confidential positions, open only to nonunionized employes, were extremely limited; a preemptory period of three years during which all foreign technicians were to be substituted by Mexicans; reductions or movements of personnel could be effected only with the previous agreement of the union locals and after approval of the Federal Labor Board, and, in the case of dismissal of employes, payment of an indemnification amounting to 90 days' salary plus 20 days for each year of service and a further 10 per cent of the total by way of accrued savings funds; the 40-hour work week of five consecutive days of eight hours starting on Monday; full medical, surgical and hospitalization services free of charge to workers and their families in case of occupational and nonoccupational illness and accident; heavy indemnifications for occupational and nonoccupational risks, including the payment of half the premium of a life insurance policy of 4,000 pesos for each permanent employe; retirement and old age pensions, the former starting after age 55 with 25 years of service at 70 per cent of wages; vacations of 21 days and 30 days depending upon length of service, with full pay, which was to be working days with all Sundays, holidays, etc., excluded; savings funds on the basis of a 10 per cent contribution from the employer and a 10 per cent salary deduction; a wide range of general cultural and recreational benefits, such as full schooling, scholarships, technical studies and practical training, sports fields and gymnasiums, discounts of 10 per cent to workers on products made or for sale by the companies, etc.; heavy rates of extra pay for work under special conditions, including double pay for work in any outside job when it happened

(Continued on Page 241)

DON'T wait for a decision on solvent extraction to put in Sharples centrifugal acid treating. The single solvent processes require acid treating anyway, and by the time the solvent process is operating, the Sharples plant will probably have repaid its costs.

Sharples' experience in centrifugal acid treating is world wide. Plants are operating in the United States, Argentina, France, Italy, Czechoslovakia, Germany, Japan and Spain.

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QUESTIONS ON TECHNOLOGY

By Charles K. Francis, Ph. D., Technical Editor

Words Minerals and Subsoil Have Special Meanings

Please give me the definition for "Minerals" and also "Subsoil" as used in the oil and gas business. "Minerals" are inorganic and could be solid, liquid, gases or vapors. Subsoil means everything under the surface of the ground and would therefore include all the minerals. Is this right?—Y. C.

The questions should be submitted to an attorney. What may be said here on a subject of this type is only a very general opinion and can be of no value in relation to the conveyance.

The opinion of those engaged in the petroleum industry relating to the meaning of the word minerals, is that petroleum and natural gas may be classified under the term.

Subsoil is an agricultural term, meaning the earth material which immediately underlies the soil proper or the portion in which most crops are grown. It is usually weathered and inactive in the production of crops. Subsoil does not appear to be a proper word to describe everything under the surface of the ground, it would certainly not include the first stratum of rock.

Formula for Estimating Number of Isomeric Hydrocarbons

Would you kindly furnish the algebraic formula whereby the number of possible isomers of an aliphatic hydrocarbon may be found when the number of carbon atoms and the number of hydrogen atoms is known?—W. T. A.

Efforts have been made by chemists and mathematicians to develop a formula by which the number of isomeric hydrocarbons could be calculated, the first attempt to derive such a formula was made in 1875. Recent investigations of the problem have shown that no simple mathematical relationship exists between the total number of isomers and their carbon content. Henze and Blair established a fundamental principle for the solution, stating the problem was solved only by establishing a relationship between the number of isomeric hydrocarbons of a given carbon content and the previously calculated number of isomeric alcohols of lesser carbon contents. The hydrocarbons being separated according to their scheme into classes according to even and odd carbon content, N. Those in which N is odd are also divided into group A, whose graphic formula can be divided into two parts, (N+1)/2 carbon atoms and (N—1)/2 carbon atoms; and group B hydrocarbons, whose graphic formula cannot be so divided.

For the hydrocarbons of even carbon content, in calculating the number of isomers in group A, two factors are utilized: (I) Number of possible radicals of N/2 atoms, and (II) number of possibilities, without exception or repetition of combining the alkyl radicals of N/2 carbon atoms with those of N/2 carbon atoms." The number of paraffin alkyl radicals of a given carbon content is the same as the number of isomeric alcohols of that carbon content. Following recognized principles of the combination of radicals, the number of combinations of $T_{N/2}$ alkyl radicals of N/2 carbon atoms, taken one at a time, with the $T_{N/2}$ alkyl radicals of N/2 carbon atoms, taken one at a time, may be calculated by the formula:

$$T_{N/2}\ (1+T_{N/2})$$

A similar development is made for hydrocarbons of odd carbon content. The number of possible combinations will equal:

$T_{(N-1)/2}\ (1+T_{(N-1)/2})$, where T is the total number of alcohols of all types containing the number of carbon atoms represented by its subscript. The combination of the remaining (N+1)/2 with (N—1)/2 will form the balance of the isomers of group A and the calculation of their numbers made from:

$$T_{(N-1)/2}\ (T_{(N+1)/2} - T_{(N-1)/2})$$

The total number of isomers in group A equals:

$$T_{(N-1)/2}\ (1+2\ T_{(N+1)/2} - T_{(N-1)/2})$$

Sample calculation:

Group A:

$$N = 14;\ N/2 = 7$$

$$T_7\ (1+T_7)/2 = 39\ (1+39)/2 = 780$$

The above is given simply to indicate the nature of calculations, as developed by Henze and Blair, the details may be found in the reference.

NUMBER OF ISOMERIC HYDROCARBONS OF THE METHANE SERIES

Carbon content	No. of isomers	Carbon content	No. of isomers
1	1	11	159
2	1	12	355
3	1	13	802
4	2	14	1,858
5	3	15	4,347
6	5	16	10,359
7	9	17	24,894
8	18	18	60,523
9	35	19	147,284
10	75	20	366,319

Carbon content	No. of isomers
25	36,797,588
30	4,111,846,763
40	62,491,178,805,831

The totals obtained by the use of these mathematical formulas agree exactly through the tetradecanes with the numbers required by theory, as tested by writing all possible structural formulas.

References: Henry R. Henze and Charles M. Blair, The Number of Isomeric Hydrocarbons of the Methane Series, J. Amer. Chem. Soc., 53, 3077, 1931. See also Henze and Blair, same 53, 3042, 1931.

Questions on Petroleum Technology may be sent to Dr. Charles K. Francis, The Oil and Gas Journal, Tulsa, Okla. When a copy of the answer is desired postage should be enclosed.

CHEMICALS FOR THE PETROLEUM INDUSTRY

Diphenyloxide

(Diphenyl Ether)

Use—Heat transfer agent.

Form—White crystalline solid which melts to a clear colorless liquid.

Formula—$C_6H_5.O.C_6H_5$.

Molecular weight—170.

Specific gravity—1.073.

Boiling point—489° F.

Specific heat—0.55 B.t.u./lb. at 302°-482° F.

LIMITATIONS

Freezing point 78.8° to 80.2° F.

Note. Exceptionally stable to heat at 752° F. and 150 pounds pressure. Miscible with most organic solvents; insoluble in water.

Correcting Oil Received and Delivered For Temperature

We buy oil on a volume corrected to 60° F. in the field, and deliver on the same basis. Some of the oil is treated and may have a temperature as high as 120° F., while the other oil is usually around atmospheric temperature. Since all the oil at the receiving point and delivery point is corrected to 60° F., should we have any volume loss in transit due to temperature, and if so, is there any method of calculating this loss?—N. O. C.

Under the conditions stated, there will be no volume loss in transit due to temperature. The standard method for measuring all oil volumes at 60° F. has been adopted for the purpose of avoiding inaccuracies in reporting stocks, deliveries, etc., and consequently values.

The following is quoted from The Significance of Tests of Petroleum Products:

"Petroleum products are frequently sold on the basis of volumes delivered corrected to 60° F. These volume corrections are made by the use of approved tables which show the magnitude of the correction as a function of the gravity of the product, regardless of its source or character. The gravity of a petroleum product must, therefore, be known whenever volume corrections are to be made."

Pipe line deliveries assume correct tank strappings and accurate withdrawals from tanks. Some disputes may arise from carelessness with respect to these factors.

Reference: The Significance of Tests of Petroleum Products, page 25, Amer. Soc. Test. Mats.

Treatment of High Sulfur Oil In the Producing Field

Am interested in finding out what practical method can be employed for the removal of sulfur from crude oil at the well, by the operator or producer, so as to make acceptable crude oil for the pipe line purchaser.—W. D. S.

The kind of treatment that may be applied to crude oil for the reduction of sulfur must depend upon the nature of the sulfur compounds contained in the oil. It is fortunate that most of the crude oils produced in the United States do not contain very large quantities of sulfur, so the necessary purification is accomplished in the refineries. In some fields crude oil is produced in which the percentage of sulfur as the gas hydrogen sulfide is so high as to make the handling of the oil especially hazardous because of its toxicity. Besides, such oils have an objectionable odor which is extremely offensive, and the sulfide is corrosive to the common metals.

The hydrogen sulfide oils may be partially purified in the field on the producing lease by simply washing by passing through water at ordinary temperature. Where an adequate supply of water is available, it may be used to remove some hydrogen sulfide because cold water will dissolve about three times its own volume of the gas. This operation should be followed by treatment with a dilute solution of caustic soda or sodium carbonate. This sort of treatment is applied in suitably designed washing towers.

There are several other chemicals that may be applied for hydrogen sulfide removal from gas or oil. The method and the selection of the chemicals will be governed by the location and the quantity of hydrogen sulfide it is desired to remove.

There is a meritorious patented process available for hydrogen sulfide removal. The address of the company which is in charge of the design and construction of the plants will be supplied upon request.

PROBLEMS FROM READERS

Edited by L. G. E. Bignell

Estimated Production Costs in Lisbon Field, Louisiana

In a lime formation, such as the Lisbon field, Louisiana, with one well to 40 acres, and assuming the cost of one well, fully equipped and turned into the pipe line, and with allowance for standardizing same would be $40,000, and with the assumed production per acre of 10,000 bbls., what would be the operating cost during the life of the lease, or, for recovery of all oil? This, of course, refers to the operating cost after the well is completed and equipped and does not include the cost of the well. What would be the cost of operating four (4) wells, that is, if 160 acres were drilled with one well to each 40-acre tract?—J. N. M.

There is no direct answer to your question because there are so many unknown factors which would influence production costs there is no way of arriving at definite conclusions.

In the first place you have placed the estimated recovery per acre for Lisbon field about twice as high as the figure we used in the estimate of reserves published in the Annual Issue of The Oil and Gas Journal January 28. Our figures place the acreage at 3,700 acres and the ultimate recovery at 18,500,000 bbls. or 5,000 bbls. per acre.

If you will refer to the July 8, 1937, issue of The Oil and Gas Journal page 65 you will find our report on Lincoln and Claiborne parishes, Louisiana, which covers the Lisbon field. In that report the reserve estimate is placed at 500 bbls. per acre foot. So the thickness of the pay section on this lease in question is important.

For production costs you are referred to an article by the writer published in The Oil and Gas Journal of October 4, 1934, on Oklahoma City field, Oklahoma. In this article the following unit cost of production and sales value of the oil for that field for three years is given.

Item—	Three-yr. weighted average
Range of gravity, °A.P.I.	34-42
Production (company interest—bbls.)	27,327,828
Depletion	$0.076
Depreciation	0.119
Amortization on intangible development cost	0.121
Operating cost	0.123
General overhead and administrative	0.283
	$0.722
Deduct: Gas sales and miscellaneous revenue	0.019
Net cost	$0.703
Interest on invested capital	0.143
Net cost, including capital	$0.846
Average selling price	$0.716

This only gives a general idea of the items entering into production costs. The wells in Oklahoma City cost from $85,000 to $150,000 to drill. Pumping equipment costs from $7,500 to $10,000 per well for surface machinery. Tubing and rods to be added. The Oklahoma City wells are about 6,500 feet deep while the discovery well in Lisbon field was only 5,379 feet deep.

The difference in producing one well or four would be very slight per well. The labor item would be higher for the four wells but not very much increase because the lease could be taken care of with the same number of men whether it contained one or four wells.

Actual lifting costs in Oklahoma City field vary from 11 cents to more than 30 cents per barrel. There are several kinds of production units used and the same classes of equipment could be used in Lisbon.

The producing zone in Lisbon field is the Pettit lime at the base of the Lower Glen Rose section. This lime varies in porosity but it is usual practice to acidize the wells upon completion of drilling. The first cost of acidizing will be $600 for acid and service plus cost such as swabbing, running and pulling tubing and hooking up the well.

It is usual practice to acidize these wells when the flowing rate slows down. The cost of the second acid treatment, consisting of from 4,000 to 7,500 gallons of acid will be about $1,000 for an average treatment of 5,000 gallons. This cost of second and subsequent acid treatments would have to be added to production expense in Lisbon field because the figures given for Oklahoma City did not cover acidization.

The last posted price on Lisbon oil was 98 cents per barrel. If the production cost is 85 cents per barrel there would be a 13-cent margin and from that figure it is possible to estimate total profit to be expected in producing this oil.

Re-leasing Oil Lands

In the case of an oil and gas lease in the Mid-Continent region which has been dropped by the original lessee: Suppose another operator wishes to lease the acreage, must he contact every royalty interest holder besides the landowner, and have all parties sign the new lease? Or will it be sufficiently legal to secure signature to cover only 51 per cent of the royalty? The type royalty referred to is perpetual and participates in bonuses and rentals as well as the type royalty which does not participate in any bonuses and rentals.—W. B.

The answers to your questions are found in the following quotation from "Oil and Gas Royalties." by Samuel H. Glassmire, attorney, Tulsa. The chapter quoted will be found on page 128 of the 1930 edition of this book.

Each of the fractional owners become a cotenant or lessor necessary to a future valid lease on the whole. These several owners, residing in remote places and unknown to each other, naturally differ widely concerning the terms of a new lease or as to the amount of bonus each should receive.

Renewing of an expiring valuable lease thus becomes an intricate problem and operators are frequently forced to abandon such renewals in despair. It has even been seriously suggested that some legislation, by statutes of limitation or laws otherwise defining the prerequisites of possessory and nonpossessory property rights, may ultimately become necessary to quiet titles to lands on which leases have expired, as against inchoate interests therein.

There are over 600 individual owners of producing royalty in the Seminole fields under a single lease. A few years ago, when a new field was opened, close-in leases were comparatively easy to obtain. Now it is more a question of obtaining producing royalty than of obtaining leases.

When a new oil field is opened nearly every lease for miles around is already owned by one of the major oil companies. Consequently as leasing of land proceeds far ahead of production, royalty is either acquired under high-priced proven production or is obtained under strictly wildcat acreage, depending on the future rentals and bonuses to pay out.

Precious Metals In Oil Field Brines

Do you have any record concerning the amounts of precious metals present in oil field brines, spring waters, etc.? Also the methods used in analysis? Has a commercial plant ever been built to attempt extraction of precious metals from water?—B. L.

For report on work done along the line of research in all fields of chemistry you are referred to Chemical Abstracts published twice a month by the American Chemical Society, Mills Building, Washington, D. C. If you have access to a file of those abstracts you can ascertain if anything has been published along the line of your interests. If you do not have access to a file of Chemical Abstracts you might write to the American Chemical Society at the above address.

There are many laboratories analyzing oil-field brines. Tests for bromine, iodine, and magnesium are common laboratory procedures. In Midland, Mich., there is a large chemical company established many years ago and founded upon the extraction of solids from oil-field brines found in wells drilled in the center of the Michigan Basin. It is reported this company, Dow Chemical Co., makes over 300 chemicals from these brines.

In a plant extracting bromine from sea water the Dow Chemical Co. has actually extracted a small quantity of gold. This plant is located near Wilmington, Del., and so far as we know is the the only place where gold has ever been actually extracted from sea water, although its presence in sea water has been known for a long time.

Spanish Land Terms

In field reports the Spanish terms such as "vara," "labor," and "league" are often used in describing locations in Texas. Can you give me the conversion values for such measurements in U. S. Standards?—C. J. D.

The following table is taken from a set of handy scales prepared by W. A. Rounds, P.O. Box 934, Fort Worth, Tex.

1 vara = 33⅓ inches = 2.7777 feet. 36 varas = 100 feet.

16½ feet = 1 rod, 1 perch, or 1 pole. 40 rods = 1 furlong or one-eighth mile.

1 chain = 100 links = 66 feet. 1 link = 7.92 inches.

1 mile = 5,280 feet = 80 chains = 1,900.8 varas.

1 acre = 208.71 feet square = 75.1357 varas square.

1 acre = 43,560 square feet = 5,645.38 square varas.

1 square mile = 27,878,400 square feet = 3,613,040.45 square varas.

1 labor = 100 varas square = 2,777.77 feet square = 177.14 acres.

1 league = 5,000 varas square = 13,888.88 feet square = 4,428.40 acres.

FIELD OPERATIONS

Summarizing the Week's Developments

KANSAS—A discovery oil well was completed in section 29-17-9w, Ellsworth County, between the Lorraine and Heiken pools. First Arbuckle lime production was uncovered in the Sittner pool, Stafford County, heretofore producing only from Kansas City lime. A wildcat in section 2-17-13w, Barton County, was showing for small production. Saturated cores in a well in section 29-21-12w, indicated a one-half mile northwest extension for the Sittner pool, Stafford County.

OKLAHOMA—A 203,500,000-foot gas well was completed on the west side of the Cement field, Caddo County, to rate as second largest Oklahoma gasser ever drilled. A wildcat in section 34-21-6w, Garfield County, pool opener, was estimated good for 300 to 500 bbls. of oil naturally. The second well in the Ramsey pool, Payne County, blew in for 300 bbls. an hour Monday.

TEXAS—Operators are going far away from production in the K.M.A. field in the hope of extending the big area, but three such outposts are showing discouragingly this week. New capital continues to enter the field, paying fancy prices for acreage. The largest well yet found in the Bryson pool, in Jack County, flowed 115 bbls. the first hour, then fell to 50 bbls. an hour. A showing in Wilbarger County indicated prospects of a new Canyon lime pool. A pool was opened in Bee County, in Southwest Texas. A deeper pay was found in the Bay City pool in Matagorda County, Texas Gulf Coast, and a new pay in the Lafourche Parish, Louisiana Coast. In the West Texas fields the Slaughter pool in Hockley County, on the farthest north line of counties in the Permian Basin area, was extended by a well flowing 260 bbls. of oil in 11 hours. It proves the pool to be on a large structure, thus far proven for a length of 4 miles. A well flowing 2,156 bbls. was completed in the Bennett pool in Yoakum County. Some geologists believe this pool will connect with the Wasson pool, 4 miles distant. The pool opened in Yoakum County by Bohago & Bond is being extended, and the Seminole pool in Gaines County has a prospective extension well a mile from production. Ector County completions continue to register large average initial production.

CALIFORNIA—In the Kettleman Hills field in California the deep Avenal zone of Eocene age was further proven productive, but the output is not up to expectations. Seven wells were completed in the Wilmington field and average daily production for the week was increased to above the 100,000-bbl. mark for the first time. A 4,800-bbl. well was completed in the Santa Maria Valley field. A 35,000,000-foot gasser was brought in in the Rio Vista gas field in Solano County. The Ten Section field was extended by a 2,172-bbl. well.

PENNSYLVANIA—Another large potential producer was added to the Music Mountain area of the 63-year-old Bradford field in Pennsylvania by the Emery interests, making the fourth big well recently found in what has been dubbed the Sliverville sand.

Completions in All Fields

(Week Ending February 21, 1938)

	Oil	Gas	Dry	Total	1938 total comp. to date	1937 total comp. to date
N. Y., Pa. and W. Va.	68	10	6	84	770	697
Ohio	1	10	5	16	144	133
Indiana	1	0	2	3	15	26
Kentucky	3	2	3	8	104	17
Illinois	9	0	3	12	79	1
Michigan	8	2	6	16	102	108
Kansas	23	2	7	32	286	274
Oklahoma	23	2	12	37	260	345
Texas:						
North Central Texas	33	1	17	51	357	352
West Texas	41	0	8	49	357	323
Texas Panhandle	8	0	2	10	119	86
East Texas	45	0	1	46	369	295
East Central Texas	3	0	2	5	58	87
East Texas Border	1	0	0	1	21	69
Gulf Coast Texas	26	0	5	31	179	165
Southwest Texas	31	1	4	36	291	476
Total Texas	188	2	39	229	1,751	1,853
North Louisiana	8	0	0	8	86	56
Gulf Coast Louisiana	7	0	4	11	81	58
Total Louisiana	15	0	4	19	167	114
Arkansas	3	0	1	4	32	10
Montana	1	0	0	1	7	12
Wyoming	2	0	0	2	22	15
Colorado	0	0	1	1	1	3
New Mexico	5	0	1	6	85	99
Utah	0	0	0	0	0	0
California	22	1	2	25	218	183
Total United States	372	31	92	495	4,043	3,890
Total previous week	344	57	98	499		
Difference	28	26	6	4		

Outstanding Fields--Highlights

(Week Ending February 21, 1938)

FIELD—	Rigs up	Wells drlg.	Weekly oil completions	Initial prod.	Total No. oil wells	Daily av. prod.
TEXAS						
Hastings	3	10	6	3,448	475	20,289
McCampbell	1	6	2	275	106	4,410
Saxet	3	6	1	120	585	34,428
Benavides	3	11	7	1,195	148	6,030
East Texas	36	84	45	2,417	24,595	425,048
Talco	2	3	1	193	614	24,300
K.M.A.	50	115	11	8,970	146	7,500
Ector County	15	75	18	23,209	876	26,500
Winkler County	9	23	4	1,971	1,577	38,050
OKLAHOMA						
Fitts-Jesse	4	14	2	450	961	68,550
Oklahoma City	4	12	0	0	1,055	117,200
KANSAS						
Barton County	8	26	4	1,801	293	10,150
Ellis County	5	21	4	9,911	282	10,065
Rice County	6	26	2	813	1,108	33,950
Russell County	9	42	5	3,731	1,010	28,295
NEW MEXICO						
Lea County	16	110	4	246	1,626	96,680
LA-ARK-TEX						
Rodessa, Ark.	0	10	0	0	63	7,910
Rodessa, La.	0	6	0	0	445	42,990
Rodessa, Tex.	2	21	1	720	395	30,440
Lisbon, La.	3	11	6	5,275	178	9,615
Shuler, Ark.	1	16	2	2,220	33	14,470
MICHIGAN						
Buckeye	6	26	4	1,764	357	26,131
ILLINOIS						
Central Illinois	31	91	9	5,950	284	24,700
CALIFORNIA						
Wilmington	9	34	7	13,730	361	103,250

Eastern Field Report

By STAFF CORRESPONDENT

New Oriskany Test Started in Fayette County, Pennsylvania

PITTSBURGH, Pa., Feb. 21.—Another Oriskany sand test is starting on Chestnut Ridge in southwestern Pennsylvania which will be of great importance to the lower Eastern fields. In Springhill Township, Fayette County, L. J. Houze Convex Glass Co. is moving in material on the Paul Dunham farm, on the Bruceton Quadrangle about 1.1 miles north of the West Virginia line; 8 miles east of Point Marion, where the glass company is located, and about 9¼ miles airline south of the gas well on the Summit Hotel property.

In South Union Township, Fayette County, Potter Development Co., William E. Snee and others have shut down No. 2 Summit Hotel on Chestnut Ridge at 6,658 feet to run 6-inch casing. The top of the Onondaga is between 6,640 feet and the present depth but the Chert has not been reached. No. 2 is running higher on structure than No. 1. Casing and cementing will take about one week after which drilling will be resumed. No gas in the Onondaga is expected until about 11 feet in the Chert, if it conforms to the first well.

A large extension to the Oriskany gas field in Kanawha County is indicated with a fair showing of gas in the test of Joe Rubin and others on the Lawrence Smith heirs in the Poca district. There was about 1,000,000 feet of gas showing in the top of the sand reached at about 4,925 feet. The test is about 2½ miles north 30 degrees west of Sissonville, and on Allen Fork of Left Fork of Poca River, and within a half mile of the Jackson County line. This tends to prove as being possible gas producing that area from the Linden Drilling Co.'s test on the John B. Kidd heirs farm 3½ miles northeast of Sissonville, rated good for over 5,000,000 feet a day, across the southwestern tip of Jackson County to the test on the Smith farm. The subsea Oriskany top in the Smith test appears higher than that in the Kidd well.

In Southeast Ohio, two oil wells and one dry hole were reported. In Muskingum County, Gas Producing Co. of Ohio completed a 55-bbl. well on the John O. Sidle farm, section 5, Licking Township, in Clinton sand at 3,150 feet. It had been shot.

In Licking County, G. S. Lacknett and others No. 4 W. W. Reynolds in section 16, Perry Township, was completed in the Berea sand at 775 feet. It produced 15 bbls. the first day after the shot. In section 7, same township, Stricker & Armbuster drilled a second test on the O. O. Priest farm through the Berea sand to 650 feet. It had a showing of gas and a light showing of oil, and will be plugged.

SOUTHWEST PENNSYLVANIA

A late report from Indiana County, Pennsylvania, of the Equitable Gas Co. No. 3232 on the Angelo Farraro farm in South Mahoning Township places the Murrayville at 1,102-35 feet with 368,000 feet of gas at 1,130 feet. In this township, the same company made a location for No. 3234 on the Robert McLane farm.

In Peters Township, Washington County, R. M. Dudin and others No. 2 J. E. Johnson, which was reported as a small gas well in the Fifth sand at 2,593 feet was plugged and abandoned.

In Somerset Township, Washington County, Victor D. Behm test on the J. D. Amos farm found Thirty-foot sand at 2,208-22 feet and some gas at 2,216 feet and was drilling at 2,260 feet. Furman Nuss and others are drilling at 1,620 feet on the R. C. Garber farm. Wherry, Polonis and others had reached 1,630 feet on the Joseph Polonis farm.

In Morris Township, Washington County, the Duquesne Gas Co. is drilling at 1,872 feet in the J. E. Day test. In Cross Creek Township, Bloom and others have started drilling on the F. L. Cummins farm.

In Plum Township, Allegheny County, Hope Construction & Refining Co. was drilling at 3,835 feet in No. 4 C. G. Mallisee. In Beaver County, Braden & Herron were drilling at 1,215 feet No. 1 W. N. Bell.

Greene County

In Center Township, Greene County, Carnegie Natural Gas Co. is drilling at 1,905 feet in No. 3 J. H. Orndoff, and South Penn Oil Co. is drilling at 1,770 feet in No. 12 Samuel Harvey. In Whiteley Township, Equitable Gas Co. is drilling at 2,915 feet, deepening No. 1 Smith Fuller. The Fifth sand was topped at 2,889 feet, with 134,000 feet of gas at 2,891-93 feet. In Washington Township, this company has started drilling No. 2 Sadie A. Connor.

In Richhill Township, O. I. Dille and others reached 462 feet in the test on the Jacob Livingood farm and is pulling 10-inch casing. J. B. Orndoff is moving in the tools for No. 2 G. M. Scott in Center Township.

Deep Tests

In Mount Pleasant Township, Washington County, the test of Norwood P. Johnston and others on the James McBurney farm was bottomed at 7,050 feet. No sand was found below the Helderberg that would correspond with the Stormville Conglomerate (Coeymans), except, possibly, a very hard silt bed at 6,982 feet. Temperature measurements by C. E. Van Orstrand, U.S.G.S., were made to bottom. The hole is being plugged back and the Oriskany sand will be shot from 6,795 to 6,825 feet as there was a small showing of gas somewhere in the hole after reaching the Oriskany.

In Fayette County, Wasson & Co. reached 500 feet in the test on the J. H. Sorg farm in North Union Township on Chestnut Ridge. Progress was delayed while the crew was drilling a water well. In Wharton Township, the Greensboro Gas Co. is drilling at 850 feet J. R. Thompson farm.

WEST VIRGINIA

Two small producers were completed in West Virginia. In Kanawha County, Pure Oil Co. completed No. 282 on Williams Coal Co. tract in the Cabin Creek district at 3,301 feet, in Berea sand, and it is good for 5 bbls. a day.

In Tyler County, the Rae Oil Co. completed a test on the Ralph Brooks farm in the Cow Run sand at a depth of 755 feet and it is showing for 2 bbls. a day.

Gas Wells

In Gilmer County, H. B. Scott and others completed a fair test on the Ella Sands and others lease in Center district at 1,960 feet. The Blue Monday sand was at 1,930-60 feet with a total of over 5,000,000 feet of gas throughout the sand. In Glenville district, the Pittsburgh & West Virginia Gas Co. completed No. 7608 on the H. A. Moffett farm at 1,438 feet. The Big Injun sand was at 1,430 feet with 3,819,000 feet of gas at 1,438 feet.

In Marshall County, O. M. Fox and B. L. Frye completed a test on the Frank Phillips farm in Cameron district at 1,870 feet. Big Injun sand was topped at 1,780 feet and gas gauging 863,000 feet a day was found at 1,862-67 feet. In Liberty district, Guy B. and A. C. Patterson, on the Lyman Fowler heirs, drilled through the Fifth sand to 3,140 feet and it was a dry hole.

In Ritchie County, Glen F. McBurney and others drilled on the A. L. Echard farm in Murphy district to 2,315 feet, through Big Injun sand. It will be plugged back to Keener sand at 1,830 feet and given an acid shot to produce the gas which now gauges 75,000 feet a day. In Union district, F. R. Ball drilled a test on the John F. Jobes farm through the Injun sand to 1,967 feet and it was dry.

Oriskany Field

In the Elk-Poca Oriskany gas pool in Kanawha County, several wells were completed and several are nearing completion. United Fuel Gas Co. completed three wells in Poca district, the largest of which is the No. 4,765 on the Francis Dawson farm at 5,080 feet with the Oriskany sand topped at 5,072 feet and a final gauge of 23,257,000 feet of gas per day, or one of the largest wells in the field. No. 4,780 on the L. K. Johnson and others tract is showing 4,311,000 feet a day at 4,825 feet with the Oriskany topped at 4,777 feet and the well not fully completed. The No. 4704 Oscar Gibson is drilling at 4,983 feet with the Oriskany topped at 4,964 feet and a gauge of 963,000 feet a day.

In Poca district, the Spartan Gas Co. completed the test on the Ernest Fisher farm at 4,851 feet with the Oriskany sand topped at 4,830 feet and a gauge of 16,080,000 feet a day. Everett Starcher has a new well on the F. M. Drake farm in this district which is showing only 143,000 feet a day at 5,231 feet.

The final gauge of the United Fuel Gas Co. test No. 4781 on the Virgil C. Tate farm in Poca district was 969,000 feet a day with a depth of 4,861 feet and the Oriskany at 4,820 feet.

Two locations were announced in Poca district, United Fuel Gas Co. No. 4,769 on the L. E. Eden farm and D. H. Stephenson & Co. No. 1 on the Rozella Shamblin and others tract. The elevation is 808 feet.

In Elk district, the Columbian Carbon Co. topped Corniferous lime at 5,054 feet on the Nora Hamilton farm. In Poca district, the United Fuel Gas Co. reached that formation at 4,726 feet in No. 4786 C. C. Fisher. Linden Drilling Co. topped Corniferous at 4,709 feet on the A. T. Mairs heirs farm.

In Elk district, Columbian Carbon Co. is drilling at 330 feet on the Margaret Rayhill farm. Cameron Oil & Gas Co. is drilling at 1,760 feet in the Henry Hansel test. Linden Drilling Co. is shut down on the S. D. Robinson farm.

In Poca district, United Carbon Co. is drilling at 4,075 feet in No. 1 Eulah Miller; 1,685 feet in No. 1 William R. Young; 925 feet in No. 1 S. Fisher. Mullins Gas Co. is down 3,975 feet in the Della M. Faber and others test. West Virginia Gas Corp. is drilling at 2,115 feet in No. 2 O. A. Vandine and others and at 1,711 feet in No. 1 John and Sadie Dixon. Hays Oil & Gas Co. is casing at 4,800 feet in the H. L. Evans test. Joe Rubin rigged up the Carney heirs test. The Pitmar Gas Co. is drilling at 2,625 feet in the Albert Moore test. Godfrey L. Cabot, Inc., is drilling at 1,893 feet in the G. G. Dawson test. The Liosag Fuel Co. has rigged up on the H. C. Matthews farm. In Union district, Columbian Carbon Co. is rigging up on the Nelson H. Cavender farm.

Deep Tests

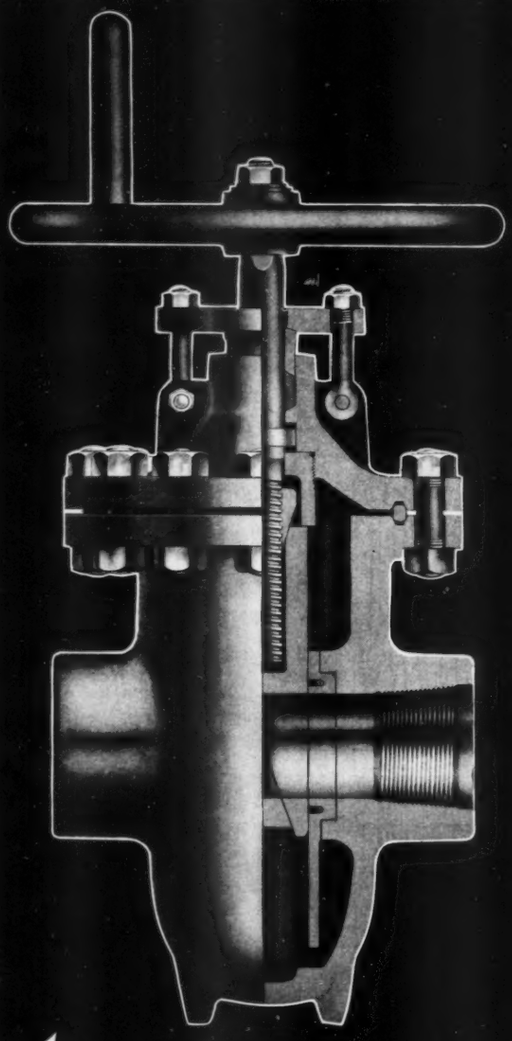
A hitherto unreported deep test is that of the Shinnston-Lumberport Gas Co. on the E. E. Heldreth farm in Eagle district, Harrison County, which was a former Fifth sand well and has been deepened to 5,557 feet. It is located 1 mile northwest of Wyatt along the Harrison County-Marion County line about 6 miles south of Mannington. The Oriskany sand is expected to be found at about 7,000 feet.

The test of W. H. Bickel on the Reese Blizzard farm in Tygart district, Wood County, was acidized, and after standing, the oil and gas from the top of the Oriskany sand showed no improvement and the well will be abandoned.

In Clay County, Pittsburgh & West Virginia Gas Co. was drilling at 6,259 feet on the Jesse Chapman farm in Otter district. The top of the Corniferous lime was at 6,122 feet.

In Steel district, Wood County, Belmont Quadrangle Co. is drilling by lost tools on the C. D. White farm at

(Continued on Page 241)



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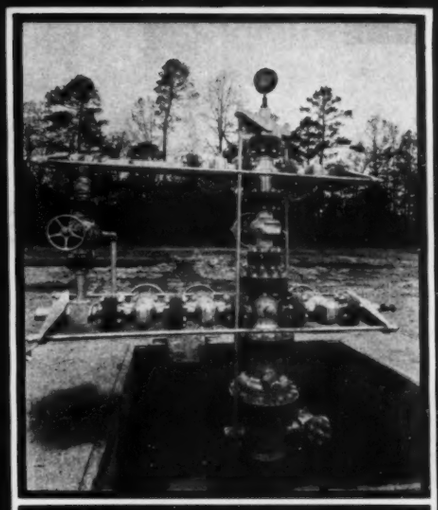

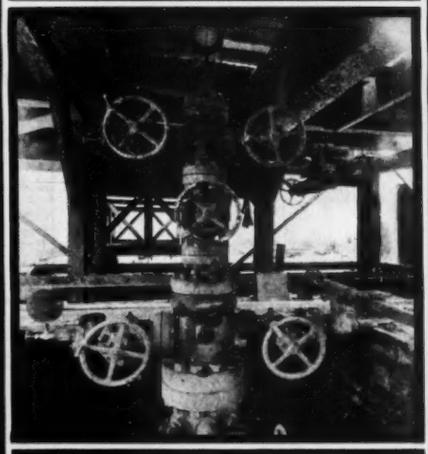

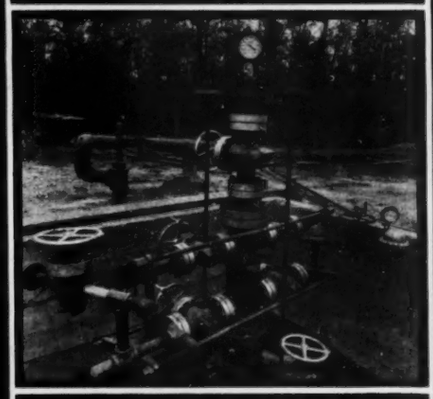

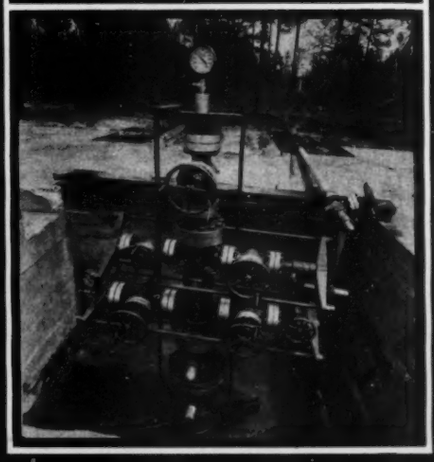

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North Louisiana, Arkansas

Lisbon Led in Completions; Lease Transfer Is Important

By GEORGE WEBER

SHREVEPORT, Feb. 21.—A looming production test on a South Arkansas wildcat, and the cyclone damage to oil properties in the Rodessa field marked the week's most important news in the North Louisiana-Arkansas sector. New locations increased in the Marion County section of Rodessa, and in the Lisbon and Cotton Valley fields of Louisiana, and numerous completions were made in the Lisbon field during the week.

In the Rodessa field the severe tornado did most damage along the northern edge of Rodessa townsite, where a number of supply houses were levelled. Comparatively little damage was sustained by oil companies. Seven pumping derricks were blown down, and one well blew wild for a short time when a christmas tree hookup was broken. The Union Production Co. suffered greatest loss, with three derricks, a boiler station, two tank batteries and some meter houses damaged. The Arkansas Fuel Oil Co. killed a well on the west edge of Rodessa townsite after the production derrick overturned, breaking the well head hookup. The gas and distillate producer ran wild for about 14 hours before being shut in.

No damage was sustained at the several natural gasoline plants in the field, but the idle North Caddo refinery, which has been shut down for several months was partly wrecked.

One completion was made in the Rodessa field during the week. Heyser, Heard & Clardy No. 3 Henderson, in the Bennington Survey, made an initial production of 30 bbls. per hour through a three-fourths inch choke with tubing pressure of 125 pounds and casing pressure of 350 pounds. Seven-inch casing was set at 5,986 feet and total depth is 6,022 feet.

Marion County, embracing the Jefferson-Lodi sector of Rodessa is due for increased activity as evidenced by the number of new locations. Twenty-three rigs are now in the field, twenty-one of which are actively drilling, making the southwest end of the field by far the most active section of Rodessa at the present time.

In the shallow Caddo field of Caddo Parish, Northwest Louisiana, the J. F. Mitchell No. 1 Muslow is testing a shallow sand at 1,600 feet in section 31-21-15.

Lisbon Completions

The Lisbon field of Clairborne and Lincoln parishes gained a total of six new producers during the past week. One of these extended the producing limits of the field a short distance to the southeast.

Atlantic Refining Co. No. 2-D Patton, C S half SE SE section 29-21-4 came in making 58 bbls. per hour for the first ten hours on a one-fourth inch choke. Tubing pressure was 200 pounds, casing pressure, 165 pounds and total depth is 5,246 feet. Saturated lime was cored at 5,229-36 and 5,241-45 feet.

J. R. McMurray No. 1 Bean, C N half SE NW section 32-21-4 made an initial production of 250 bbls. in 12 hours on a 21/64-inch choke with tubing pressure of 40 pounds and casing pressure of 600 pounds. Five and one-half inch casing was set at 5,146 feet and total depth is 5,167 feet. The well was treated with 4,000 gallons of acid. Saturated lime was cored at 5,151-58 and 5,161-64 feet.

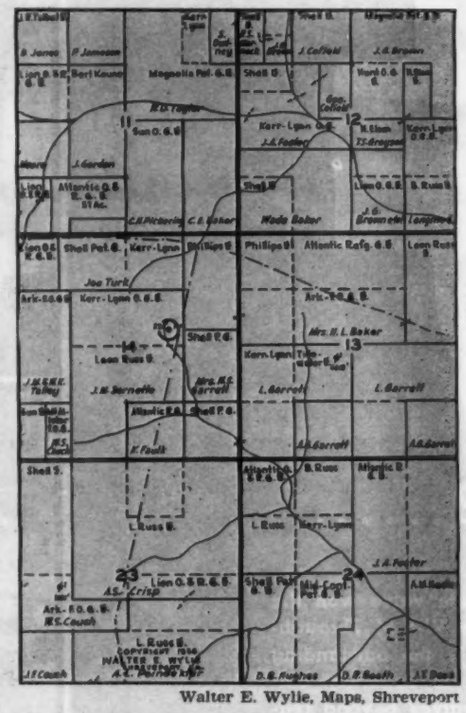
A. O. Olson and others No. 2 English, N half NE SE section 29-21-4, made 70 bbls. per hour on a three-fourths inch choke with tubing pressure of 125 pounds, after acidizing with 3,000 gallons. Total depth is 5,168 feet.

In the Lincoln Parish sector of the field Delta Drilling Co. No .1 Weiss & Tatum, C S half NW NE section 7-20-4, extended the limits of the field to the southeast by flowing 298 bbls. in seven hours through a one-half inch choke. Tubing pressure was 100 pounds. It had been acidized with 5,000 gallons. Saturated lime was cored at 5,324-31 feet, and 5½-inch casing set at 5,324 feet, total depth 5,341 feet.

Love Bros. No. 2 Patton Estate, another Lincoln Parish well, in C S half SW SE section 6-20-4, made an initial of 21 bbls. per hour on a 12/64-inch choke with tubing pressure of 240 pounds and total depth 6,316 feet. Three thousand gallons of acid were used.

Sugar Creek Tests

In the Sugar Creek area of Claiborne Parish two tests are active. The Union Producing Co. and Standard Oil Co. of Louisiana No. 2 Brownfield, to the deepest



Walter E. Wylie, Maps, Shreveport

Kerr-Lynn Oil Co. No. 1 Barnett, section 14-17-20, Columbia County, east of Magnolia, Ark., is attracting much attention as operators prepare to make production tests at 7,052 feet where casing was set last week. The wildcat indicates the presence of a new producing area

test now active in the district. Operators are attempting to straighten the hole which was drilled to 9,964 feet and plugged back to 8,930 feet. Union Producing Co. No. 1-A Kilpatrick in the same area is reported to have twisted off drill stem at the latest reported depth of 5,971 feet.

Cotton Valley Activity

The Cotton Valley field of Webster Parish gained two oil wells during the week in different horizons. Greatest news from that field, however, was the transfer of several important leases from the Standard Oil Co. of Louisiana and Robert D. Webb to the H. L. Hunt Co. According to agreements, Hunt has staked locations for three tests. Two of them, No. 6 Babb in C NE SW section 14-21-10 and No. 8 Davis, in C NW NE section 23-21-10 are rigging up. The third is a deepening project on No. 19 Hope, formerly completed by the Cotton Valley Corp. on February 14, 1929, for 4,500,000 feet of gas. Arrangements for drilling deeper are being completed. Agreements on the new tests call for drilling to the deep Bodcaw sand at 8,300 feet, unless commercial production is found at a more shallow depth.

The Holloway sand in Cotton Valley gained two new producers. H. L. Hunt Co. No. 1 Hope, C SW NW section 24-21-10 made 20 bbls. per hour on a 12/64-inch choke through perforations at 5,623-32 feet in 7-inch casing set at 5,838 feet. Tubing pressure was 1,150 pounds and casing pressure 1,550 pounds. Total depth is 5,852 feet.

The second Travis peak producer is A. G. Oliphant No. 2 Banks, C SE NW section 34-21-10 making 568 bbls. in 16 hours on a one-half inch choke. Tubing pressure is 500 pounds and casing pressure 1,100 pounds. Total depth of the well is 5,804 feet. The Hollaway sand was cored at 5,740-57 feet. These two completions bring the total number of producers in the Holloway to five. A sixth test in the Travis Peak formation North American Oil Consolidated Co. No. 1 Stewart is swabbing approximately 100 bbls. a day in a probable half-mile west extension to the sand.

Estimated Daily Production

Estimated daily gross production all companies week ending February 18, 1938:

NORTH LOUISIANA

Bellevue	680
Caddo light	3,890
Caddo heavy	2,455
Converse	650
Cotton Valley heavy	210
Cotton Valley light	*4,490
De Soto and Red River	1,350
Elm Grove	330
Haynesville	3,000
Holly	95
Homer	2,505
Lisbon	9,615
Pleasant Hill	115
Rodessa	42,990
Sarepta-Carterville	290
Sligo	450
Sugar Creek	305
Urania	2,890
Zwolle	775
Total	77,085

SOUTH ARKANSAS

Buckner	405
Champagnolle	1,175
El Dorado	1,840
Lisbon	275
Miller County	400
Nevada	675
Rodessa	7,910
Shuler	14,470
Smackover light	1,985
Smackover heavy	15,870
Stephens	560
Troy	1,300
Urbana	1,205
Total	48,070

Texas side of Rodessa field 30,440 bbls. daily.

*2,990 bbls. is distillate.

Southern Arkansas

A possible new discovery in Columbia County, South Arkansas, is attracting considerable attention. The Kerr-Lynn Oil Co. No. 1 Barnett, in section 14-17-20, is due for a production test. The wildcat, situated east of the town of Magnolia, cored a slightly porous lime at 7,659-64 feet and ran 7-inch casing. The casing was stuck at 7,052 feet, and after unsuccessful attempts to lower it, it was cemented at that depth. Operators are moving in 3-inch drill pipe.

The wildcat prospect, together with other operations in Columbia and Lafayette counties, is attracting much attention to the area. Leasing is unusually active at present in South Arkansas, and wildcat exploration is expected to make that area one of active interest for several months.

Interest is especially keen near the town of Village.

(Continued on Page 256)

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Rocky Mountain Area

By
T. R. INGRAM

Recent Colorado Discovery Will Be Idle Until Spring

DENVER, Colo., Feb. 21.—The Texas Co. and California Co.'s discovery well on Wilson Creek, Rio Blanco County, western Colorado, made 37 bbls. in one hour through tubing while cleaning out, and was starting on a 24-hour test. The J. B. Furstenberg deep test in the old Boulder field was abandoned at 4,230 feet.

The old Torchlight field in Wyoming, second producing field in the state at a shallow depth, is to have a test to the Madison. The California Exploration Co. will deepen its discovery well on the Waugh dome to test the Tensleep. The Stanolind Oil & Gas Co. completed two of its Tensleep wells in Salt Creek.

The Cut Bank field in Montana had one completion and one new operation. The Transit & Storage Co., which bought crude for Canadian export, is retiring from the Montana fields.

The Continental Oil Co. completed a 55-bbl. well at 730 feet in the Rattlesnake pool, northwest New Mexico.

The L. R. Paige test in Jefferson County, Nebraska, was abandoned in Siliceous lime at 3,344 feet.

NEW MEXICO

The Vacuum area of Lea County continued to hold major interest in New Mexico, with three new tests being started and reports current that plans have been made for an outlet for the pool. It was unofficially reported that the Texas-New Mexico Pipe Line Co. has purchased right of way for an 8-inch line extending from the Vacuum pool to the company's Lynch station, 18 miles southwest. Work was expected to start at an early date. Completion of the pipe line is expected to stimulate drilling in the field, Vacuum oil now being stored in an 80,000-bbl. storage tank at the north end of the pool.

Magnolia Petroleum Co. No. 1-K State, C NW SE section 31-17-35, is located for a test one-half mile southeast of Skelly Oil Co. No. 1-J State, farthest east producer in the pool. Derrick was being built for the new test, which is a diagonal southeast offset to Ohio Oil Co. No. 1 State-Warn, a drilling well. Amerada Petroleum Corp. entered the Vacuum play with staking of two inside locations at No. 1 State VA, section 23-17-34, and No. 1 State VB, section 36-17-35.

Only five completions in southeastern New Mexico the past week were reported, four producers in Lea County and a failure in Eddy County.

Amerada Petroleum Corp. No. 2 Corrigan, C S half SE NE section 4-22-37, Lea County, was bottomed at 3,822 feet, plugged back to 3,771 feet, and flowed 71 bbls. of oil through choke daily. Gas gauged 750,000 feet.

Barnsdall Oil Co. No. 2 J. Whitten, SE NE SE section 33-23-36, northwest side of Cooper pool, found pay at 3,556 feet, total depth 3,625 feet, and flowed 82 bbls. of oil naturally through choke in one hour.

Gulf Oil Corp. No. 1 Greer, C NE SW section 21-22-36, southwest edge of the Eunice district, flowed 27 bbls. of oil and 5 bbls. of water daily through tubing. It was bottomed in lime at 3,842 feet.

Western Gas Co. No. 1 Cowden, SE cor. section 30-23-37, topped pay at 3,539 feet, total depth 3,625 feet, set 2⅛-inch tubing at 3,565 feet and flowed 65 bbls. of oil daily through choke.

In Eddy County, Texas Co. No. 1 Welch, C SW NE section 30-20-31, wildcat, was reported abandoned at 2,608 feet, total depth, with 150 feet of sulfur water in the hole.

Lea County

Amerada Pet. Corp. No. 6 Byrd, SE sec. 12-20-36. Loc.
Amerada Pet. Corp. No. 3 Laughlin, C NW NE sec. 9-20-37. T.D. 2,585 ft.; set 8-in. 2,573 ft.
Amerada Pet. Corp. No. 1 State VA, C SE SW sec. 23-17-34. Drk.
Amerada Pet. Corp. No. 1 State VB, C NE SW sec. 36-17-34. Bldg.
Anderson-Prichard Oil Corp. No. 1 Carlson, C SW NW sec. 21-25-37. O.W.D.D.; C.O.; to deepen.
Anderson-Prichard Oil Corp. No. 1 Harrison, SW cor. sec. 23-25-37. Drlg. 2,341 ft.
Anderson-Prichard Oil Corp. No. 2 Jal, C NW NE sec. 8-25-37. T.D. 2,540 ft.; P.B. 1,650 ft.; W.O.C.
Anderson-Prichard Oil Corp. No. 1 Wells, C SE SE sec. 5-27-37. Drlg. 3,610 ft.
Anderson-Prichard Oil Corp. No. 2 Langlie, SE sec. 8-25-37. Drlg. 3,325 ft.
Bradley Oil Co. No. 1 Downes, SE NE SE sec. 5-22-37. R.U.S.T.
Cities Service Oil Co. No. 1-H State, C NE NE sec. 17-22-36. T.D. 3,884 ft.; prep. to deepen.
Continental Oil Co. No. 1-A-22 Elliott, C SW SW sec. 22-22-37. O.W.D.D.; T.D. 3,592 ft.; shot; flwd. 69 B. O.P.D.; S.D. for engine.
Continental Oil Co. No. 3-B-6 Elliott, C SE SE sec. 6-22-37. T.D. 3,778 ft.; flwd. 18 B.O.P.D.; C.O.
Continental Oil Co. No. 1-B-9 Elliott, NW sec. 9-22-37. T.D. 3,725 ft.; flwd. 62 B.O.P.D.; tstg.
Continental Oil Co. No. 1-A-20 Jack, C NE SE sec. 20-24-37. T.D. 3,212 ft.; set 5½-in. at 3,210 ft.
Continental Oil Co. No. 3-B-31 Lockhart, SE sec. 31-21-36. T.D. 3,924 ft.; flwd. 64 B.O.P.D.
Continental Oil Co. No. 1-A-31 Marsh, SE sec. 31-20-39. Wildcat; T.D. 4,346 ft.; R.U.S.T.
Continental Oil Co. No. 2-B-23 Reed, NE SE NE sec. 23-20-36. Drlg. 1,705 ft.
Continental Oil Co. No. 8-A-14 Sanderson, NE NW SE sec. 14-20-36. Cellar, pits.
Continental Oil Co. No. 1-B-14 Sanderson, NE SW SE sec. 14-20-36. Drlg. 1,346 ft.
Continental Oil Co. No. 3-E-17 State, C NW NW sec. 17-22-36. Drlg. 3,524 ft.
Continental Oil Co. No. 1-F-1 State, C SW SW sec. 1-21-36. Drlg. 3,595 ft.
Cranfill & Germany No. 1 Weir, C NE NE sec. 15-20-37. T.D. 4,210 ft.; S.D.O.
Culbertson & Irwin No. 2 Alston, NW SW NW sec. 26-25-37. Drlg. 720 ft.
Culbertson & Irwin No. 5-A Humphrey, NE NW SE sec. 3-25-37. T.D. 3,205 ft.; set 6-in. csg.
Culbertson & Irwin No. 7-A Humphrey, NE SW SE sec. 3-25-37. Loc.
Culbertson & Irwin No. 1 Liberty Royalty, NW sec. 3-25-37. Drlg. 2,945 ft.
J. P. Cusack, Inc., No. 1 Turner, SW NE SE sec. 34-18-38. Drk.
Danglade & Clower No. 1 Currie, NE NE SW sec. 6-21-37. Spdg.
Danglade & Clower No. 1 Glier, C SW NE sec. 33-22-37. Drlg. 3,125 ft.
L. E. Elliott No. 1 Elliott, NE NE SE sec. 26-20-36. Drlg. 3,748 ft.
A. R. Eppenauer No. 1 Stuart, NW NE NE sec. 22-25-37. Drlg. 620 ft.
J. E. Farrell No. 2-C Walden, C SE SW sec. 15-22-37. Drlg. 3,700 ft.
Geo. F. Getty No. 1 Riggs, NW sec. 1-26-36. Wildcat; drlg. 2,925 ft.
Geo. F. Getty No. 1-F State, C NE NE sec. 36-17-34. Drlg. 4,169 ft.
Gulf Oil Corp. No. 6-F Bell, C NW SW sec. 36-20-36. Drlg. 3,715 ft.
Gulf Oil Corp. No. 1 Boyd, sec. 23-22-37. T.D. 3,681 ft.; tstg.
Gulf Oil Corp. No. 3 Day, SE SE SW sec. 6-22-36. Drlg. 3,566 ft.
Gulf Oil Corp. No. 1 Elliott, SW SE SE sec. 15-25-37. Drlg. 3,420 ft.
Gulf Oil Corp. No. 2-D Kutter, C SE SW sec. 8-19-37. T.D. 2,675 ft.; set 7⅝-in. at 2,665 ft.
Gulf Oil Corp. No. 1-D Mattern, SW sec. 6-22-37. T.D. 3,795 ft.; P.B. 3,787 ft.; to re-test.
Gulf Oil Corp. No. 3 McCormack, C SE SE sec. 32-21-37. Drlg. 1,285 ft.
Gulf Oil Corp. No. 1 LeMunyon, C NE NE sec. 28-23-37. Old well; T.D. 3,666 ft.; pmpd. 3 B.O.P.D.
Gulf Oil Corp. No. 2 Ramsey, C SW SW sec. 27-21-36. Drlg. 3,425 ft.
Gulf Oil Corp. No. 1 Woolworth, C NE SE sec. 30-24-37. T.D. 3,795 ft.; to test.
Humble O. & R. Co. No. 2 Greenwood, C NE SW sec. 9-22-37. Loc.
Humble O. & R. Co. No. 3 Williams, C SW NW sec. 34-24-37. T.D. 3,532 ft.
Jal Nat. Gas Corp. No. 2 Justis, NE sec. 20-25-37. T.D. 3,029 ft.; tstg.
Kan-Mex Corp. No. 2-B-3 Vaughn, NW cor. sec. 3-24-36. R.U.R.
Carl B. King No. 1-A Stuart, NW NE NW sec. 14-25-37. Drlg. 2,395 ft.
Harry Leonard No. 1 Ginsberg, NW sec. 29-25-38. Wildcat; drlg. 2,300 ft.
Magnolia Pet. Co. No. 1 State G, NW NW NE sec. 34-17-34. T.D. 4,905 ft.; P.B. 4,794 ft.
Magnolia Pet. Co. No. 1-H State, C NW NW sec. 31-17-35. T.D. 4,107 ft.; set 7-in. csg.
Magnolia Pet. Co. No. 1-I State, C NW SW sec. 36-17-34. T.D. 4,118 ft.; set 7-in. at 4,060 ft.
Magnolia Pet. Co. No. 1-J State, C NE SE sec. 22-17-34. Drk.
Magnolia Pet. Co. No. 1-K State, C NW SE sec. 31-17-35. Cellar, pits.
Magnolia Pet. Co. No. 2 State-Bridges, sec. 14-17-34. T.D. 4,593 ft.; flwd. 51 B.O. in 1 hr., naturally.
J. A. Mascho No. 1 Cloyd, C SE SE sec. 20-22-23. Wildcat; T.D. 3,516 ft.; to set whipstock.
McDowell & Weiner No. 1 Elliott, SE cor. sec. 19-21-37. T.D. 3,821 ft.; rmg. tbg.
C. T. McLaughlin No. 1 Polhamus, NE sec. 9-24-37. T.D. 3,672 ft.; S.D.
C. T. McLaughlin No. 1 Imperial Royalties, NW SE NW sec. 9-24-37. T.D. 3,436 ft.; waiting on spudder.
National Drlg. & Prod. Co. No. 1 Flint, C NE NE sec. 29-20-34. Wildcat; drlg. 3,695 ft.
Ohio Oil Co. No. 2 Grizzell, C NW SE sec. 5-22-37. T.D. 600 ft.; prep. to drill in.
Ohio Oil Co. No. 1 Hardy, NE NE SE sec. 20-21-37. T.D. 3,639 ft.; fsg.
Ohio Oil Co. No. 1 Kutter D, C SW SW sec. 18-19-37. Drlg. 3,590 ft.
Ohio Oil Co. No. 4 State-Hansen, C W½ SE NE sec. 16-20-37. Drlg. 3,730 ft.
Ohio Oil Co. No. 7 State-McDonald, C SW SE sec. 16-22-36. T.D. 3,871 ft.; C.O.
Ohio Oil Co. No. 1 State-Warn, C SE NW sec. 21-17-35. T.D. 4,110 ft.; set 7-in. at 4,100 ft.
Lem Peters No. 1 Graham, sec. 27-22-37. T.D. 3,651 ft.; tstg.
Parker Drlg. Co. No. 1 Irwin, C W½ SW SW sec. 35-24-37. Drlg. 3,120 ft.
Phillips Pet. Co. and Pure Oil Co. No. 1 Woolworth, C SE NE sec. 33-24-37. T.D. 353 ft.; rng. csg.
Phillips Pet. Co. No. 2 Santa Fe, C SW SE sec. 30-17-35. T.D. 265 ft.; set csg.
Phillips Pet. Co. No. 1 Santa Fe, C SW NW sec. 31-17-35. Drlg. 540 ft.
Plains Prod. Co. No. 1 Humphreys, NE sec. 3-25-37. Loc.
Repollo Oil Co. No. 1 Powhatan Carter, SW SW NE sec. 9-24-37. T.D. 3,705 ft.; P.B. 3,600 ft.; flwd. 29 B.O.P.D.; to test.
Repollo Oil Co. No. 3 Christmas, NW NW NE sec. 28-22-37. T.D. 3,726 ft.; P.B. 3,664 ft.; flwd. 30 B.O.P.D.
Repollo Oil Co. No. 4 Moseley, SW SE NE sec. 34-24-37. Drk.
Repollo Oil Co. No. 4 Roach, NW NW SW sec. 21-20-37. T.D. 3,875 ft.; P.B. 2,860 ft.; shot; R.U.S.T.; S. D.O.
Repollo Oil Co. No. 3-C Stuart, SE NE SW sec. 10-25-37. O.W.D.D.; R.U. to deepen.
Repollo Oil Co. No. 4-D Stuart, SW sec. 10-25-37. Drlg. 3,023 ft.
Rowan Drlg. Co. No. 2-A Elliott, C NE SW sec. 27-22-37. Drk.
Samedan Oil Co. No. 5 Hughes, C NE SW sec. 10-23-37. T.D. 3,608 ft.; swbd. 60 B.O.P.D.
Shasta Oil Co. No. 2 Woolworth, NE NW NW sec. 28-24-37. Drlg. 75 ft.
Shell Oil Corp. No. 2 Grizzell, C NE SE sec. 8-22-37. Drlg. 2,724 ft.
Shell Pet. Corp. No. 1-A State, C NW SE sec. 16-23-36. T.D. 3,440 ft.; rng. csg.
Shell Pet. Corp. No. 4-E State, C SW NW sec. 12-20-36. Drlg. 3,800 ft.
Shell Pet. Corp. No. 1 J. L. Whitten, NE SW SE sec. 33-23-36. Cellar, pits.
Sindorf et al No. 1 Glier, NE cor. sec. 33-22-37. T.D. 1,279 ft.; set 8¼-in. csg.
Skelly Oil Co. No. 5 J. B. Baker, C SE NW sec. 27-22-37. T.D. 3,620 ft.; tstg.
Skelly Oil Co. No. 2 Hill, C NW NE sec. 6-21-37. Drlg. 2,300 ft.
Skelly Oil Co. No. 3 G. W. Sims, C NW NE sec. 9-23-37. T.D. 3,642 ft.; C.O.
Skelly Oil Co. No. 1-C R. R. Sims, sec. 3-23-37. Drlg. 3,688 ft.
Skelly Oil Co. No. 1-E W. P. Sims, C NW NE sec. 10-23-37. T.D. 3,625 ft.; flwd. 452 bbls. in 24 hrs.
Skelly Oil Co. No. 1-K State, NE NE NW sec. 32-21-37. Drlg. 998 ft.
Skelly Oil Co. No. 1 Toby, C SW SW sec. 7-24-37. T.D. 1,215 ft.; set 9⅝-in. 1,203 ft.
Stanolind O. & G. Co. No. 2-A Hill, C NE SE sec. 6-21-37. Loc.
Stanolind O. & G. Co. No. 2-C Hill, C SW NW sec. 5-21-37. T.D. 1,395 ft.; set 9⅝-in. 1,379 ft.
Stanolind O. & G. Co. No. 3-C Hill, C NW NW sec. 5-21-37. Loc.
Stanolind O. & G. Co. No. 4-B Myers, C SW NW sec. 21-24-37. Drlg. 2,645 ft.
Sun Oil Co. No. 4 Stuart, C SE NE sec. 15-25-37. Drk.
W. H. Street No. 3 Woods, C NW NE sec. 22-22-37. T.D. 3,688 ft.; P.B. 3,558 ft.; tstg.
Texas Co. No. 1 Corbin, C NW SW sec. 19-18-33. Drlg. 4,135 ft.
Texas Co. No. 3 Fristoe, NW SE NE section 3-25-37. Drlg. 1,520 ft.
Texas Co. No. 14 Lieu Lands, SW SW NW section 19-20-37. Drlg. 3,260 ft.
Texas Co. No. 1-B Moberly, C NE NE sec. 21-26-37. Drlg. 2,780 ft.
Texas Pacific C. & O. Co. No. 8-A State, Acct. 2, C SE SE sec. 7-22-36. T.D. 3,460 ft.; tstg. pipe.
Texas Pacific C. & O. Co. No. 9-A State, Acct. 2, NW SW NE sec. 7-22-36. T.D. 1,484 ft.
Tide Water Associated Oil Co. No. 2 Day, C E½ NW NW sec. 6-22-36. T.D. 1,712 ft.; set 7⅝-in. at 1,703 ft.
Two States Oil Co. No. 2 Downes, C NE NE sec. 6-22-37. Drlg. 3,406 ft.
Western Gas Co. No. 1 Davis, C SW SE sec. 33-23-37. Drlg. 920 ft.

Eddy County

F. E. Baker No. 1 Eddy, NE sec. 12-22-27. T.D. 2,117 ft.; fsg.
Barnett Oil Dev. Co. No. 1 King Permit, C NW SE sec. 23-26-30. T.D. 938 ft.; S.D.O.
Carper Drlg. Co. No. 3 Gissler, C E½ E½ NW sec. 23-17-30. R.U.M.
D. & B. Oil Co. No. 2 Jenkins, SW NW NW sec. 20-17-30. T.D. 3,265 ft.; flwd. 20 B.O.P.D.
D. & B. Oil Co. No. 3 Jenkins, NE NE NW sec. 20-17-30. Loc.
Emperor Oil Co. No. 4 Puckett, C NE NE sec. 24-17-31. Drlg. 1,250 ft.
Emperor Oil Co. No. 5 Puckett, C SW NE sec. 24-17-31. T.D. 445 ft.; S.D. repairs.

Finley & Cherry No. 1 Buchley, C NW NW sec. 28-16-31. Wildcat; T.D. 3,750 ft.; S.D.
Flint Prod. Co. No. 1-B State, SE sec. 20-17-30. Drlg. 3,830 ft.
C. J. Frederick No. 1 Reed, C NE SW sec. 28-24-28. Drlg. 1,350 ft.
F. W. & Y. Oil Co. No. 8-A Gissler, NE NW NE sec 23-17-30. Drlg. 1,860 ft.
F. W. & Y. Oil Co. No. 9-A Gissler, C SE NE sec. 14-17-30. Drlg. 450 ft.
F. W. & Y. Oil Co. No. 1-B Gissler, SW sec. 15-17-30. Drlg. 2,618 ft.
F. W. & Y. Oil Co. No. 2-B Gissler, C NW NW sec. 24-17-30. T.D. 3,505 ft.; swbd. 37 B.O.P.D.; to reacd.
F. W. & Y. Oil Co. No. 3 Jackson, C NW SE sec. 13-17-30. T..D. 2,953 ft.; fsg.
Grayburg Oil Co. No. 11 Burch, NE NE SE sec. 19-17-30. Drlg. 560 ft.
Grayburg Oil Co. No. 4 Keely, SE SW NE sec. 24-17-9. Drlg. 3,070 ft.
M. A. Grisham No. 1 Chaytor, NE sec. 10-24-26. T.D. 1,967 ft.; S.D.O.
H. A. Hartwell No. 1 Vandagrift, NE NE SE sec. 8-18-27. Drlg. 1,285 ft.
R. L. Holcomb No. 1 State, NW sec. 22-17-28. T.D. 1,264 ft.; S.D.O.
Woodworth Hawkins No. 1 Mack, C SW SW sec. 20-24-27. T.D. 2,402 ft.; 100 ft. W.I.H.
C. F. Ingram No. 1 Page, NE NE SW sec. 15-21-28. T.D. 1,495 ft.; S.D. for new rig.
B. M. Koehane et al No. 1 Shannon, SE cor. sec. 27-16-31. Drlg. 680 ft.
Paul Moran No. 1 Crawford & Smith, NW NW SW sec. 24-24-26. Drlg. 35 ft.
Murchison & Closuit No. 2-A State, NW SE SW sec. 16-17-31. Drlg. 1,750 ft.
Nash & Windfohr No. 8-A Jackson, sec. 13-17-30. Pay 3,425 ft.; T.D. 3,518 ft.; tstg.
Nash-Windfohr & Brown No. 2-B Stevens, NW sec. 13-17-30. Drlg. 3,305 ft.
Pecos Valley Gas Co. No. 1 Sappenfield, C SE SE sec. 4-16-28. T.D. 40 ft.; S.D. for mch.
Repollo Oil Co. No. 3-D McIntyre, SE cor. sec. 17-17-30. T.D. 3,241 ft.; acd.; flwd. 350 B.O.P.D.
Repollo Oil Co. No. 4-D McIntyre, NW NE NE sec. 21-17-30. Drlg. 1,290 ft.
Repollo Oil Co. No. 1-B Parke, SW cor. sec. 15-17-30. T.D. 550 ft.; set 9⅝-in. csg.
Paul Sargent No. 1 State, NE sec. 16-17-31. T.D. 3,749 ft.; B.P. 3,745 ft.; tstg.
R. A. Shugart No. 1 Coulthard, C NW SW sec. 35-18-31. Drlg. 4,016 ft.
Texas Co. No. 1 Welch, sec. 30-20-31. Drlg. 2,550 ft.
W. K. Royalty No. 2 State, C NW NE sec. 16-17-31. Drlg. 435 ft.
W. O. Snyder No. 1 Pecos Irrigation, C NE SE sec. 15-25-28. T.D. 3,138 ft.; tstg.
Western Drlg. Co. No. 1-A Western, SE SW NW sec. 23-17-29. Loc.
Neil Wills et al No. 1-A State, C S½ SW SE sec. 17-20-30. Drlg. 1,350 ft.
Martin Yates, Jr., No. 1 Conlon, SW NW NW sec. 7-24-27. Drlg. 1,694 ft.

Chaves County

English & Hamon No. 11 Billingslea, SE sec. 9-15-29. T.D. 3,680 ft.; P.B. 3,456 ft.; fsg.
E. J. Fisher No. 1 Etz Permit, NE sec. 23-7s-26. T.D. 1,255 ft.; S.D. repairs.
Grastorf & Caudill No. 1 Smith, C NE NE sec. 1-4s-29. Wildcat; R.U. and S.D.
J. & L. Drlg. Co. No. 2 Hurd, SW sec. 11-11-26. Drlg. 135 ft.

Curry County

Bond & Harrison No. 1 Hart ranch, C NW SE sec. 13-2n-31. T.D. 3,258 ft.; S.D.O.

De Baca County

Land Owners Oil Co. No. 1 McAdoo, SW cor. sec. 16-1s-7e. O.W. prep. to deepen from 5,850 ft.
James D. Ward No. 1 Summers, NW NE SW sec. 17-4n-20. T.D. 260 ft.; S.D.
N. F. Woods No. 1 Jones, C NE SW sec. 17-4n-20. T.D. 25 ft.; S.D.

Dona Ana County

Jules C. Bertrand No. 1 Casad Permit, sec. 24-26-5e. T.D. 47 ft.; S.D.O.

McKinley County

S. Dysart No. 1 Govt., NE sec. 14-14-10w. T.D. 1,390 ft.; fsg.

Otero County

Fred Turner, Jr., No. 1 Ella Everett, C SE SE sec. 34-22-13. Drlg. 1,550 ft.
Fred Turner, Jr., No. 1 H. V. Everett, SE SE sec. 28-22-13. Drlg. 1,700 ft.

Roosevelt County

C. S. Peterson and Conquistadores Oil Co. No. 1 Good, NW SE SE sec. 28-5s-30. T.D. 455 ft.; S.D.O.

NORTHWEST NEW MEXICO

San Juan County

Continental Oil Co. No. 70 Rattlesnake, NE NE SW section 2-29n-19w, Rattlesnake pool, was completed at 730 feet for 55 bbls. per day from sand at 709-20 and 725-30 feet.

Socorro County

Central New Mex. Oil Co. No. 1 Belen Land Grant, NW sec. 16-3n-1e. Drlg. 2,300 ft.

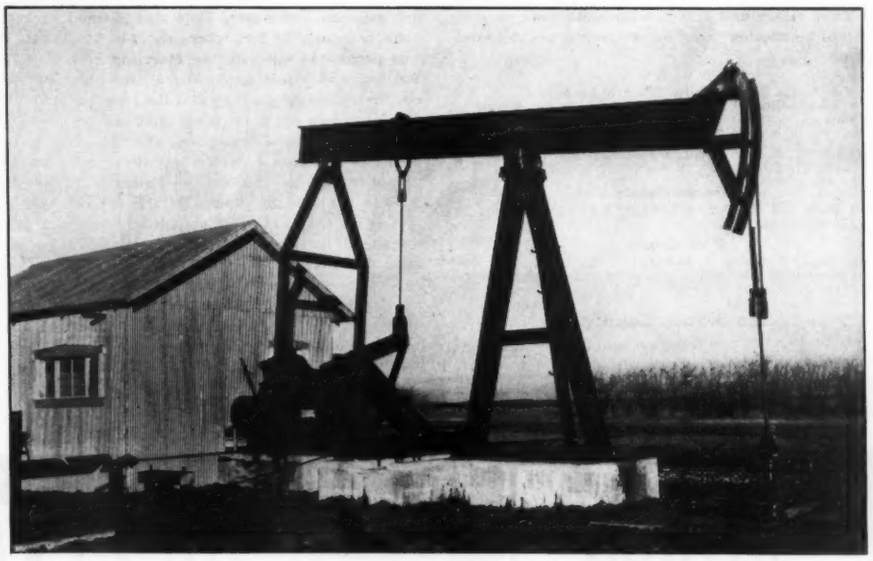
COLORADO

Boulder County

J. B. Furstenberg No. 1 Foote, NE NW SE section 20-1n-70w, in the center of the old Boulder field, was abandoned at 4,230 feet. Samples indicated that it had not yet reached the Nio-Benton. The equipment was not heavy enough to drill to the Dakota.

Cheyenne County

The Gulf Oil Corp.'s test in the Mount Pearl district is reaming at 4,500 feet to set the 9⅝-inch on top



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of show at 4,808 feet. After casing is set it will change over from rotary and drill in with cable tools. It probably will be another week before results are definitely known.

Gulf Oil Corp. No. 1 Union Pacific-Larsen, C SE NW sec. 13-13s-49w. T.D. 4,813 ft.; rmg. to set 9⅝-in. at 4,808 ft.

Grand County

Interstate O. & R. Co. No. 1 Hinman, NE SE NW sec. 11-2n-81w. S.D. 3,620 ft. for fuel and repairs.

Lincoln County

South Park Oil Co. No. 1 Lemar, NE NE NE sec. 34-11s-75w. Drlg. 5,725 ft.

Park County

Consolidated Smelting & Metals Co. No. 1 Hancock, NE NE SW sec. 7-17s-52w. T.D. 2,888 ft. in red sdy. sh.: C.O. caves and W.O. csg.

Rio Blanco County

The joint test of the Texas Co. and the California Co. on the Wilson Creek structure in their No. 1 Unit, SW SE NW section 35-3n-94w, the discovery well in the Morrison, made 37 bbls. in one hour on a test on Wednesday through the tubing while still cleaning out drilling mud and water. Hole was plugged back from 6,918 feet to 6,700 feet where the 7-inch was set. Pipe was perforated opposite the Morrison at 6,665-85 feet and the stem filled up 5,500 feet, but the well would not flow. Tubing was run and the hole circulated with water to clean out the drilling mud. Several tests were made after shutting in the well at intervals of 10 to 12 hours to build up pressure and flush out the water. It was opened for one hour on February 13 and made 27 bbls. through the tubing. It was shut in again and opened up for 30 minutes on Tuesday in which period it made 22 bbls. with a small quantity of water. After again shutting it in it was opened Wednesday and made 37 bbls. in one hour with only a trace of water. There is empty storage at the well for 1,200 bbls. and the test starting later in the week through a bean was to run for 24 hours or until storage was filled. It was planned that when the test was completed and the operators sure that all water is out, the well was to be shut in until spring.

Hugh A. Stewart, manager of the producing department of the Texas Co. for this area, says that no plans for drilling another well will be taken up until the discovery is completed. It is probable, he stated, that another well will be drilled this year to make a test of the Sundance. In the discovery well cores from the Sundance showed saturation, but on a test that horizon produced only water. Considerable surface work will be done to check the geology before a Sundance well is located. These matters will be determined in consultation with officials of the California Co., joint operator with the Texas Co.

WYOMING

Albany County

Wyco Oil Co., Inc., No. 3 Chappel, NE NE NW sec. 33-21n-76w. T.D. 2,546 ft.; fsg. D.P.

G. R. McConnell No. 1 Govt., CWL SW SE sec. 6-15n-75w. T.D. 1,065 ft.; P.B. to Muddy at 890-920 ft.; tstd. 12 B.P.D. oil and 16 B.P.D. wtr.; cmtd. csg. at 880 ft. and prep. to test.

Big Horn County

The old Torchlight field, the second producing field in Wyoming, which was discovered in 1905 and which produced 1,500 bbls. a day from 50 shallow wells at around 500 feet in 1915, is to have another deep test to the Madison in Clifford S. Johnson No. 1 Johnson. Location is in E half NW NW section 24-51n-93w. This is half a mile northwest of a test drilled in 1928 by the old Producers & Refiners Corp., which went only to 1,114 feet. Same year the Torchlight Oil Co. drilled in the SW SE section 19-51n-92w, and had some saturation followed by sulfur water in sand at 4,004-50 feet. It was believed to be off structure.

Clifford S. Johnson No. 1 Johnson, CEL NW NW sec. 24-51n-93w. M.I.M. (first report).

Prescott & Mileski No. 1 Govt, NE NW SW sec. 1-51n-93w. Spdg. (cor. loc. formerly carried under Campbell County).

Joan Oil Co. No. 1 Howell, NE NW NE sec. 32-55n-97w. T.D. 2,320 ft.; C.D.; ran 10-in. and changing from steam to gas for fuel.

Carbon County

The Ohio Oil Co.-California Co. No. 6 Union Pacific-Johnson, an outside well on the northwest side of Big Medicine Bow, is at a critical depth. It topped the Sundance at 5,438 feet and at 5,461 feet had no shows of oil or gas on a drill stem test. Location is one-fourth of a mile southwest of No. 3 Union Pacific which made 90 bbls. an hour from the Upper Sundance at 5,517-82 feet, after plugging off water in the second sand, and half a mile north of No. 3-A Kyle, which made 10 bbls. an hour in the first sand after plugging back from 5,745 to 5,643 feet.

Italo Pet. Co. No. 1 Tunney-Bragg, NE SE NW sec. 11-26n-81w. Drlg. 1,205 ft.

Sinclair-Wyoming Oil Co. No. 12-B Wertz, SE NW NW sec. 7-26n-89w. T.D. 4,217 ft.; rmg. 12½-in. hole at 4,135 ft.; base Sundance 4,140 ft.

Ohio Oil Co.-California Co. No. 4-A Kyle, 661 ft. from N line and 648 ft. from E line, sec. 26-21n-79w. Drlg. 4,900 ft.; C.D.; top Muddy 4,690 ft.

Ohio Oil Co.-California Co. No. 6 Union Pacific-Johnson, C SW SE sec. 23-21n-79w. Drlg. 5,461 ft.

Ohio Oil Co. No. 14 H. & C., SE NW SW sec. 35-20n-78w. Drlg. 650 ft.

Converse County

New Era Fuel Corp. No. 1 Layne, SE NW NE sec. 27-32n-69w. S.D.O. 761 ft.

New Era Fuel Corp. No. 1 Gaspar, NW NW SW sec. 25-32n-69w. T.D. 871 ft.; tstg.

D. O. Gray No. 1 Wm. Lane, SW SE SE sec. 22-32n-69w. S.D. 525 ft.

Ainsworth Oil Co. No. 1 Marberger, NE SE NE sec. 34-32n-69w. Drlg. 760 ft.

Wyshawn Oil Co. No. 1 Lindley, NW SE sec. 34-32n-69w. Drlg. 320 ft.

Osage Trust Co. No. 1 Miller-Govt., SE NW NW sec. 29-32n-69w. T.D. 751 ft.; U.R. 6⅝-in. to bttm.

Hall-Thornton et al No. 1 Roth, SE NW SE sec. 13-32n-69w. T.D. 500 ft.; cmtd. 8¼-in. at 493 ft.

Putnam et al No. 1 Probesh, SE SE sec. 29-32n-69w. Drlg. 525 ft.; S.G.

Chadron-Osage Oil Co. No. 1 O'Meara, NE SE sec. 28-32n-69w. Set 8¼-in. at 250 ft.; drlg. ahead.

Fremont County

Sinclair-Wyoming Oil Co. No. 2-B Muskrat, NW NW NE sec. 4-33n-92w. T.D. 4,074 ft.; ran cmt. plg. at 600-900 ft.

Stanolind O. & G. Co. No. 1 Govt., C SE SE sec. 3-33n-96w. T.D. 7,500 ft.; cmtd. 9⅝-in. at 7,450 ft. W.O.C.

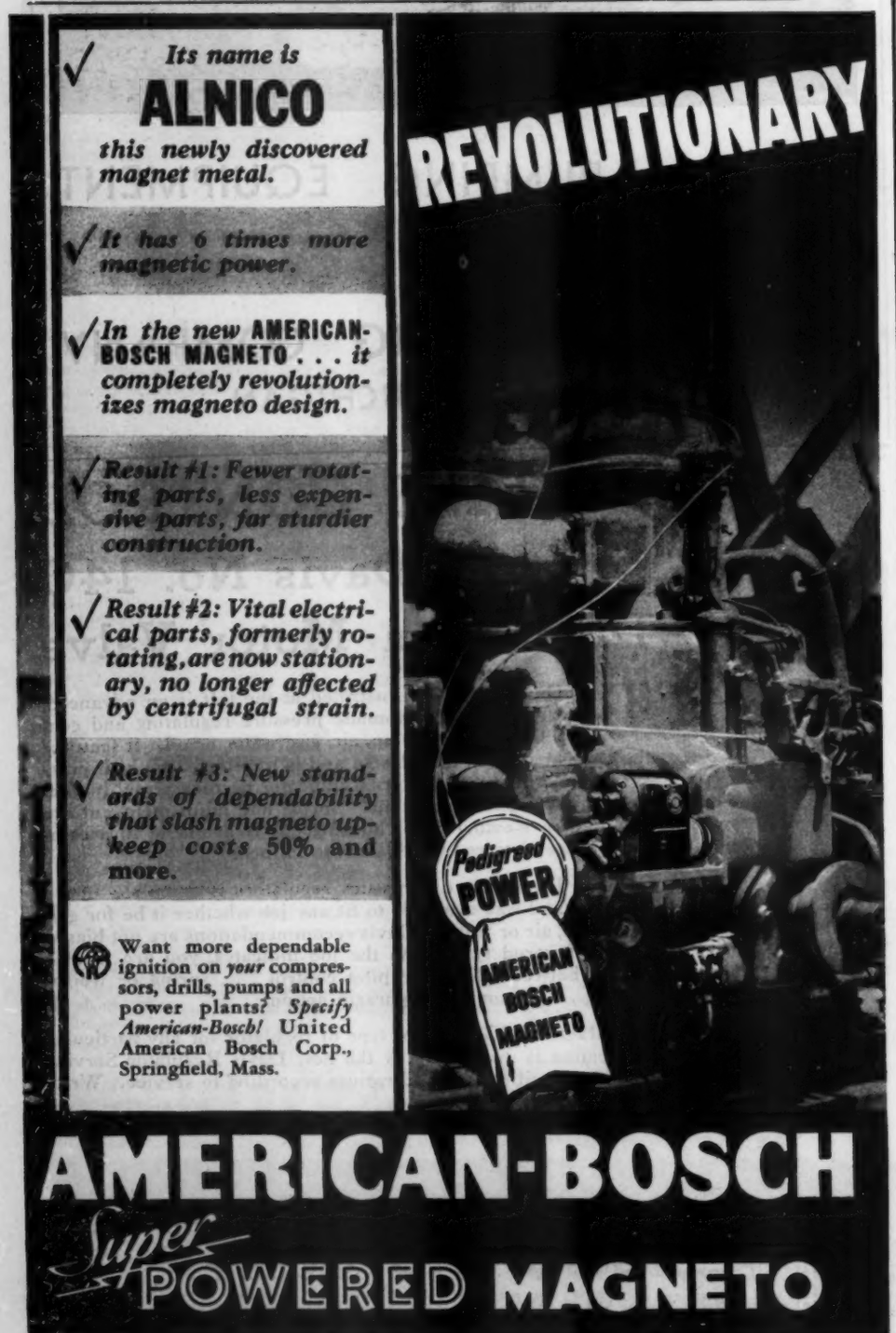
Consolidated Oil Properties No. 3 Ewart, C SW SE sec. 16-1n-14w. T.D. 700 ft.; rng. form. test.

Hot Springs County

The California Exploration Co. is preparing to go back into its No. 1 Government, NE SE NE section 12-44n-97w, the discovery well on the Waugh structure, and deepen it to the Tensleep. It was completed in the Embar at 3,776-3,806 feet in 1935 for 538 bbls. of 27.8-gravity black oil and recently went to water. It is the only well on the structure. An east offset drilled by the same company was abandoned.

Natrona County

Plans for the proposed unitization of the Salt Creek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field still are in the formative stage and it probably will be six months, or more, before the details are in shape for final consideration.

Two of the four Tensleep sand wells of the Stanolind Oil & Gas Co. in the Salt Creek field, which have been testing under a new plan for completing them were listed this week as completions. Its No. 11 Wyoming Oil-Tensleep 35, C NE SW section 35-40n-79w, made 5½ bbls. an hour through a 3/32-inch choke and its No. 11 Wyoming Associated-Tensleep 35, C NE NW section 35-40n-79w, made 5.7 bbls. per hour on a one-eighth inch choke. A water lense in the pay horizon formerly gave considerable trouble in completing the wells. The method used on these wells was to cement casing on bottom, perforate at 10-foot intervals and test with packers above and below. It was believed that by this method the water seam could be located and shut off. Two other wells are being completed in the same manner.

General Pet. Corp. No. 1 Govt., C NW SE sec. 21-35n-77w. Cg. for the Wall Creek below 6,500 ft.
Stanolind O. & G. Co. No. 8 T.P.-Wyo.-Asso.-35, C NW NW sec. 35-40n-79w. T.D. 3,997 ft.; tstg.

Niobrara County

The department of the interior will receive bids up to noon February 28 for the government's royalty oil from the Lance Creek field. Bids are to be on the basis of 1, 3 and 5 years beginning April 1. Average royalty oil accruing to the government from sands down to and including the basal Sundance was 16,800 bbls. per month last year. Average from the Minnelusa cannot be given at this time, but in October it was 9,100 bbls. and in November 9,500 bbls.

Argo Oil Co. No. 5 Ford, C SW SE sec. 33-36n-65w. Rng. rig foundations.
H. D. Moore et al No. 1 Beregren, NW sec. 23-35n-63w. Drlg. 636 ft. in variegated sh. (formerly W. A. Maupin et al).
Continental Oil Co. No. 3-A Diehlman, SE SE SW sec. 5-35n-65w. Drlg. 2,503 ft.
Argo Oil Co. No. 6 Ford, NW SW NW sec. 33-36n-65w. Drlg. 4,080 ft.
C. L. Price No. 1 Lamb, NE NW NW sec. 7-35n-65w. Drlg. below 4,700 ft.
Ohio Oil Co. No. 8 Converse Sheep, NE SE SW sec. 32-36n-65w. Drlg. 4,937 ft. in Leo (?) sd.
Continental Oil Co. No. 3 Apex-1, SE SE NE sec. 34-36n-65w. Drlg. 4,523 ft.; out of basal Sundance at 4,070 ft.

Park County

Ohio Oil Co. No. 4 Mack-O.P.C.-4, SE SW SE sec. 30-58n-99w. T.D. 3,092 ft.; P.B. to 2,850 ft.; cmtd. 8⅝-in. at 2,790 ft. with 300 sacks.
Resolute Oil Co. No. 4 N. P., C NE NW sec. 21-57n-101. shot 40 qts. at 8,625-54 ft. in Frontier; C.O.; S.G., no oil.
Resolute Oil Co. No. 3 N. P., C NE NE sec. 20-57n-101w. Pmpd. 7 to 8 B.P.D. at 8,670 ft.; not officially comp.

Sweetwater County

Rocky Mountain Drlg. Co. No. 1 Lee, NE NW SE sec. 10-19n-104w. Drlg. below 2,831 ft.
Mountain Fuel Supply Co. No. 1 Agnes Fay, 330 ft. from E line and 1,980 ft. from S line, sec. 18-18-103w. T.D. 2,506 ft.; recmtd. at 1,840-1,910 ft.; W.O.C.
Mountain Fuel Supply Co. No. 1 Clark, NW SE SW sec. 12-19n-104w. S.D. 300 ft.
Sinclair-Wyoming Oil Co. No. 77, SE NE NE sec. 10-26n-90w. T.D. 4,049 ft.; shot 100 qts.; swb. 40 bbls. in 3 hrs.; rng. 2½-in. tbg.
Selegna Oil Co. No. 1 Union Pacific, SW SW sec. 11-20n-104w. Drlg. 2,982 ft.

Washakie County

Bruce C. Teeters No. 1 Govt., CEL NE SE sec. 25-48n-91w. Drlg. 1,300 ft.; 10-in. at 81 ft.
Lewis Storm et al No. 1 Brome, C SE SW sec. 30-48n-90w. Drlg. 1,980 ft.; below objective; prob. abd.

Weston County

Wyoming O. & G. Co. No. 8, SW SW NW sec. 24-46n-64w. R.U.
H. D. Wiltse No. 14, NW NW NE sec. 17-46n-65w. R.U.
Patterson Oil Co. No. 19, CSL SE SE sec. 17-46n-63w. R.U.
John Brorphy No. 1 George, SW SE NW sec. 26-48n-64w. T.D. 1,964 ft.; W.O. csg.

MONTANA

Big Horn County

P. O. Oil & Gas Co. No. 1, NW NE NE sec. 25-9s-35e. Drlg. 340 ft.
E. L. Dana No. 1 Hardy, SW NW sec. 22-9s-35e. S.D. 700 ft.

Carbon County

R. C. Tarrant No. 2 Heare, NW SE NW sec. 14-6s-10e. Drlg. 1,640 ft.
Sha-Wa Pet. Co. No. 1 Govt., SW SW NE sec. 35-9s-23e T.D. 3,030 ft.; U.R. 8⅝-in. at 3,020 ft.

Glacier County

There was one completion and one new operation in the Cut Bank field.

Jack Marshall No. 2 All.-119, SE SE NW section 1-32n-6w, the first completion of the year, had 300 feet of oil in the hole at a total depth of 3,181 feet. There was a show of oil in the Sunburst at 3,020-25 feet and the Cut Bank was at 3,040-77 feet. It was shot with 130 quarts at 3,063-77 feet and is cleaning out.

The new location is the Glacier Production Co. No. 1 McNamer, which is an outside well at the north end of the gas area.

Glacier Prod. Co. No. 1 McNamer, CEL SE NE sec. 15-36n-5w. R.O.G. (first report).
Santa Rita O. & G. Co. No. 8 Tribal, C NE SW sec. 16-35n-6w. R.U.
A. B. Cobb No. 1 State, C NE NE sec. 30-37n-4w. T.D. 2,592 ft.; S.D. until spring.

Lewis and Clark County

Lewis & Clark Oil Synd. No. 1 Heilman, NW NW SW sec. 11-18n-5w. T.D. 1,190 ft.; C.D.; rng. csg.

Toole County

The Transit & Storage Co., which formerly was a purchaser of crude in northern Montana for export to Canada, is disposing of considerable equipment and supplies and indications point to its early retirement from all operations in the state. Last year it took over the old Montana Pipe Line Co. properties, and last fall discontinued the purchase of crude. The situation was brought about by the development of around 30,000 bbls. daily potential production in the Turner Valley field, which shut off the demand for imports from Montana. Six of its 80,000-bbl. tanks in Kevin-Sunburst have been sold, two of them going to the Glacier Production Co. in Cut Bank. Gradually as a market is found it will dispose of its pipe and other equipment.

The Superior Petroleum Co. No. 7 Government, NE NW NW section 12-35n-3w, lost its hole at 1,530 feet and was abandoned.

Big West Oil Co. No. 6 Gunderson, NE NW NW sec. 19-35n-2w. S.D. 850 ft.
B. A. S. Aronow No. 1 Govt., SE SE SW sec. 18-35n-2w. Drlg. 1,400 ft.
West Kevin Community Lease, Inc., No. 1 McClary, SW NE NW sec. 3-34n-4w. S.D. 1,200 ft.

Outside Kevin-Sunburst

Montana Gas Corp. No. 2 Clark, C SE SW sec. 24-37n-1w. T.D. 2,370 ft.; 5 3/16-in. at 2,364 ft.; tstg. S.O.

Yellowstone County

Broadview Dome Oil Co. No. 1 Stallinberger, NE NE SW sec. 18-3n-23e. Drlg. 4,363 ft., cores indicate hole still in Mississippian.
Riverton Oil Co. No. 1 Fox, CEL NW NE sec. 14-2n-23e. T.D. 1,795 ft.; U.R. 8¼-in. to bttm. to set on top Dakota.

UTAH

Grand County

Utah Southern Oil Co. No. 1 Hyde, SE NW NW sec. 33-22s-22e. T.D. 6,715 ft.

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THE OIL AND GAS JOURNAL

Tulsa **Oklahoma**

Columbia Crude Corp. No. 1 Rath, NW SW SE sec. 12-25s-20e. S.D. 3,000 ft. acct. weather.
Cane Creek Oil Co. No. 1 Govt., NW SW sec. 31-26n-21e. Drlg. below 857 ft.

Summit County

Longwell Pet. Co. No. 1, SE SW SE sec. 35-3n-5e. Drlg. 2,650 ft.

NEBRASKA

L. R. Page and others No. 1 Bonham, C SE SE section 1-1n-1e, Jefferson County, was plugged and abandoned in the Siliceous lime at 3,344 feet. It had no showings of oil or gas.

MEXICAN LABOR

(Continued from Page 226)

to be raining, and time and a half for such work as loading and unloading gas or petroleum.

In addition to the heavy economic burden imposed upon the companies, the administrative features of the award were equally unacceptable. These included such restrictions as the reclassification of doctors as no longer confidential; the stipulation that confidential employes had to be discharged arbitrarily by the companies if more than three complaints were lodged against them by unionized employes; that three days' leave with full pay had to be granted the men for personal reasons at any time and as often as they requested it; that no penalties could be applied against a worker reporting late for work provided this did not exceed half an hour, and that 90 days' leave without pay must be granted to the workmen when requested.

The wage scales established a minimum of $5.29 per day for the lowest unskilled labor, despite the legal minimum salary in the State of Veracruz (where most oil workers are employed) runs only from $2.45 to $3.55.

Amparo Proceedings

In view of the complete inacceptability of the award on December 29, the oil companies filed a writ of amparo before the Supreme Court asking the award be set aside. On the same day, the companies entered a petition of suspension of the award before the Federal Labor Board. January 6, 1938, the Labor Board handed down a ruling that the suspension would be granted pending decision by the Supreme Court on the amparo proceedings. The resolution stipulated the companies should pay 75 per cent of wages lost by the men during the general strike and should furnish an unlimited bond to guarantee the other benefits granted the workmen by the award. The companies have asked for a stay in the matter of the bond and of the strike pay. Discussions on both points are now being held.

Outlook for Future

The appeal to the Supreme Court is still pending and the court has announced that because of the length of the controversy and its importance it will not be able to review the case and hand down its decision until the middle of February. Meantime, the companies have circularized their workers that they cannot accept the award, as the establishment of the new working conditions proposed would effectively cause suspension of operations in the country. Prognostications as to the outcome are invalidated by the fact that neither the labor authorities nor the government have yet apparently recognized the companies' position on the two basic issues of profits and cost. Therefore, it is impossible to say at this time with any degree of certainty whether the labor situation will be remedied so the companies will be able to continue operating or whether the Supreme Court will sustain the award and precipitate a severe crisis in the industrial life of the country.

Eastern Fields

(Continued from Page 232)

3,800 feet. In Harris district, Potter Development Co. has resumed drilling on the W. H. Orem farm.

In Ripley district, Jackson County, Potter Development Co. is drilling at 1,320 feet on the Chancey farm. In Ravenswood district, W. H. Petry is fishing at 4,716 feet on the D. O. Curry farm.

New Work

In Harts Creek district, Lincoln County, Sand Creek Gas Co. made a location for No. 5 Phillip Hager along the railroad. In No. 4 the oil came from the Big lime topped at 1,444 feet.

In Monongalia County, Pittsburgh & West Virginia Gas Co. is drilling No. 5,411 Della Lemley in Clay district. In Doddridge County, Broadwater & Wilson are building rig on the W. F. Squires farm in Central district. W. H. Ahner has a rig up on the M. J. Cunningham farm and Henderson Oil Co. is drilling at 1,680 feet in the Alex Ligett test.

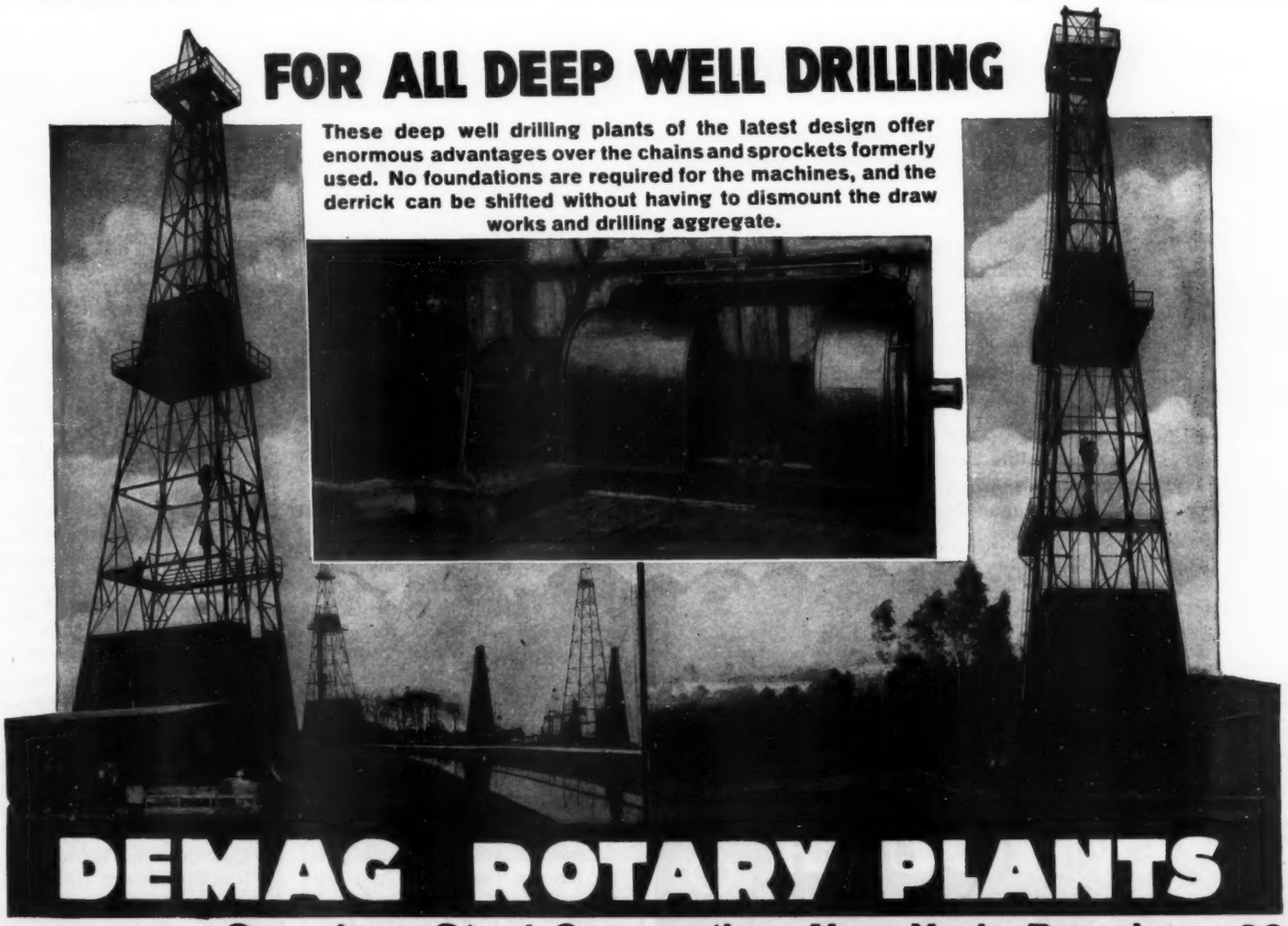
In DeKalb district, Gilmer County, Paul K. Weekley made locations on the O. S. Brannon, George C. Ellyson and F. W. Beall farms. Massey & Jarvis are skidding the rig on the Collins and Weaver farm. J. A. Tierney made a location on the G. Hart farm. Big Run Gas Co. is down 700 feet in the G. O. Bonnett test.

Canadian Petroleum Imports Decline But Exports Gain

OTTAWA, Ontario.—Petroleum, asphalt and their products imported into Canada in December were valued at $2,666,419 compared with $6,990,412 in November.

Crude petroleum imports in December amounted to 57,235,892 gallons as follows: United States, 45,540,546 gallons; Venezuela, 7,598,273; Peru, 4,097,073. November imports amounted to 160,123,621 gallons.

Petroleum and its products exported from Canada in December were valued at $132,463 compared with $116,711 in November; with a total for the year of $1,531,447.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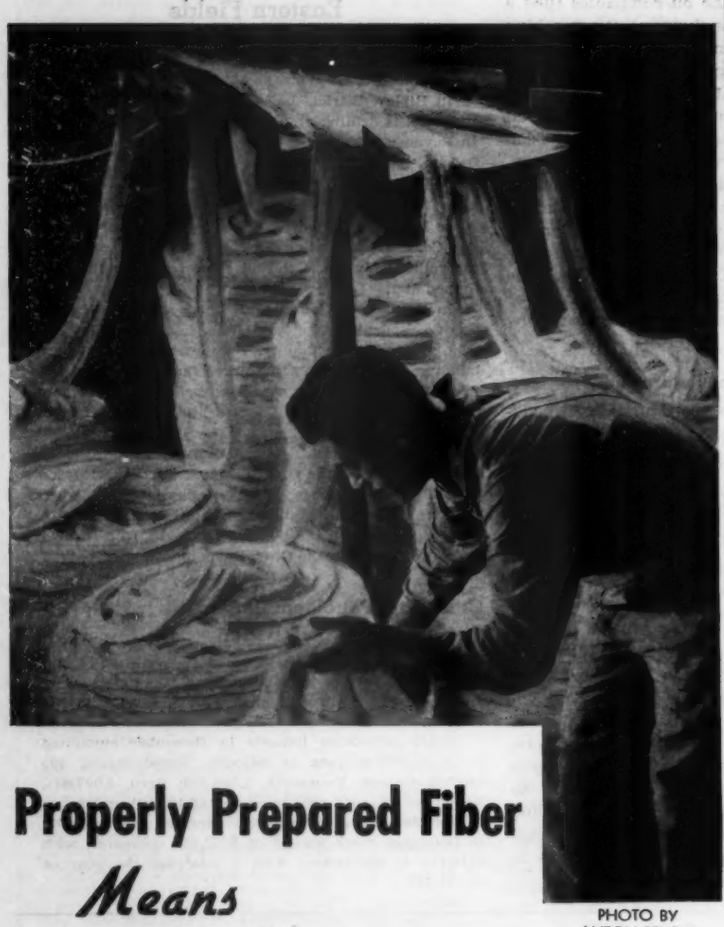

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Gas Fields of New York and N. Pennsylvania

By SPECIAL CORRESPONDENT

COUDERSPORT, Pa., Feb. 21.—Announcement of two new locations relieved an otherwise drab week in the New York-Pennsylvania Oriskany sand gas fields as three abandonments dropped the number of current operations to 17, the lowest in many months.

Sylvania Corp. has staked one of the new locations, 500 feet from the west line and midway north and south on the H. Hand No. 2 farm in Woodhull Township, Steuben County, New York. Material is now being moved in.

Wittmer and others are also moving in material on their new location on the George Caffery 80 acres in Greenwood Township, same county. The location is 1,100 feet from the south and 575 feet from the west farm lines.

New Penn Development Corp. abandoned its location on the J. Seeley farm in Woodhull Township while two Pennsylvania deep tests, both below the Oriskany horizon, were abandoned at least temporarily. They were Updegraf's test on the O. E. Erickson farm, Elk Township, Warren County, at 4,830 feet, and F. C. Deemer's wildcat on the Verstine & Kline farm, Eldred Township, Jefferson County, at 7,155 feet.

Pennsylvania Operations

New Penn Development Corp. has resumed drilling in its rotary test on the Crawford farm in Keating Township, Potter County, and is now at 8,093 feet. This company's test on the Haupt farm is shut down at 5,700 feet.

Ward Wasson reached the Onondaga lime during the past week in his test on the R. B. Hall farm, Genesee Township, Potter County, and is now shut down to case at 5,180 feet. Top of the Onondaga was at 5,165 feet.

McKenry and otners have decided to drill by the tools in their test on the Stellman farm in Rockland Township, Venango County. This hole is now bottomed at 4,429 feet. Evjen and others are drilling at 4,544 feet on the Dusenberry farm, Watson Township, Warren County, and New York State Natural Gas Co. is preparing to spud in its test on the W. A. Simmons farm in Brookfield Township, Tioga County.

New York Operations

New York State Natural Gas Co. has spudded in its test on the C. D. Carr farm in West Union Township, Steuben County, and is drilling at 325 feet on the Lyle Wheatcraft farm, Woodhull Township, this county. Salt water broke in at 1,010 feet to fill up this company's test on the S. H. English farm in Van Etten Township, Chemung County. It is being reamed to 1,020 feet and casing will be run in.

Belmont Quadrangle Drilling Co. is running casing in its hole on the F. Hilligas farm, Willing Township, Allegany County, which is down 4,790 feet. Empire Producing Co. topped the Tully lime at 4,155 feet on the Della Mulvey farm, Alma Township, same county, and is now drilling at 4,400 feet.

In other New York operations New Penn Development Corp. is shut down at 6,600 feet on the Federal Land Bank farm, Montour Township, Schuyler County, and G. L. Cabot, Inc., is moving in material on the C. Groves farm, one of its two Woodhull Township, Steuben County, locations. The other location is on the Neva Husted farm.

Another Gusher in the Old Bradford Field

BRADFORD, Pa., Feb. 21.—The fourth gusher oil well to be struck in the 63-year-old Bradford field within six months was brought in Friday by the Minard Run Oil Co. in its third Music Mountain well near Lewis Run.

Drilling will continue with the potentialities of the well as yet ungauged, according to E. H. Bryner, official of the company.

Three flows of oil from the Sliverville sand were permitted to run, coming at about hourly intervals, after which the well was shut in.

No estimate of the flow could be obtained, nor could it be learned how the well appears to compare with the other three gushers, two of which are owned by the Niagara Oil Corp. and the other by the Minard Run Oil Co. The flows were described as "nice" ones. The three other wells were rated at 1,000 to 1,200 bbls. initially.

The sand was found Friday at 1,309 feet and drilling was continued for 3 feet to 1,312 feet during the afternoon.

H. A. Melat, prominent oil man of Wichita Falls, Tex., for the past 15 years, has moved to McAllen, in South Texas. Mr. Melat was one of the original developers of the Spindletop field in South Texas and became associated with the J. M. Guffy Petroleum Co., which later became the Gulf Oil Corp. He retired from the Gulf organization four years ago at the age of 75, and for the past four years has been operating independently in Texas.

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Among Gulf Coast Drilling Contractors

Patrick & Tyrell received contract from Merit Oil Co. for a well to be drilled about 800 feet northeast of the discovery well in the Cedar Bayou field in Chambers County. One large diesel-electric rig is on a new location at the Hardin field for Humble Oil & Refining Co. while another rotary is active in the Dickinson field for Mid-States Oil Co.

Jack Frazier has moved one of his large rotaries out of the Hardin field to the Eureka field on the northwest edge of the Houston city limits, where he is rigging up for his No. 1 Vollmer and Nieman in the John Reinerman Survey. It is southeast of the discovery well, a distillate producer, and is scheduled to be drilled below 8,000 feet. He is also rigging up for an interesting test in the northern part of the Hardin field which will be drilled for himself.

Henry De Arman has reached the sand at the Sandy Point field in Stanolind Oil & Gas Co. No. 3 Fite, and casing is being cemented for a production test. He has also moved a rig to Goliad County where he will drill a joint wildcat with the Windward Oil Co. on the Drier lease in the B.S.&F. Survey No. 7.

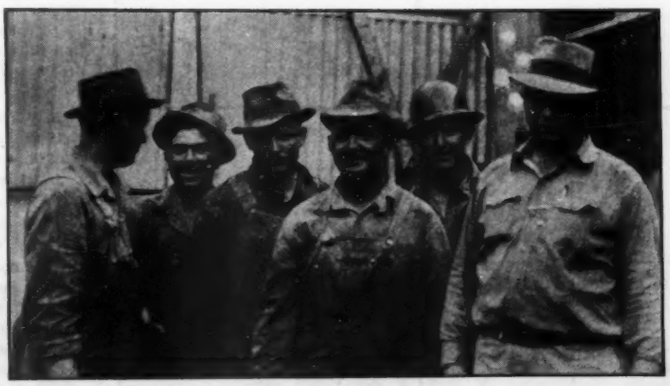
Rowan Drilling Co. is running casing in the newly opened Fairbanks field in Amerada Petroleum Corp. and Stanolind Oil & Gas Co. No. 1 Peters, an outpost southwest of the discovery well. The hole is bottomed in salt water sand at 6,894 feet, and the section from 6,824-44 feet is scheduled to be tested. The rig will probably be moved about 8,000 feet east of the discovery well for No. 1 Elizabeth White in the Clarkson Survey. In the meantime the company is completing its own well at Danbury and has two operations listed at the Venice dome in Plaquemines Parish for the Pan American Production Co.

Rutherford Drilling Co. is making a squeeze job, preparatory to making a production test in the Buckeye field for United North & South Development Co. on the Stoddard lease. The company is nearing the contract depth at West Saxet on No. 1 Stewart and has two outfits operating at Van Vleck for Skelly Oil Co.

Harry L. Edwards is preparing to make a production test on his No. 1 Robertson in the East Telferner field after plugging back from 5,624 feet to the discovery horizon at 5,100 feet. Three other rigs are located in the Hardin, Dickinson and Lockridge fields for McAlester Fuel Co., Coast Petroleum Co. and McCurdy and Johnson.

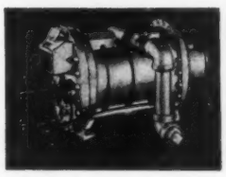
New locations made the past week along the Texas Gulf Coast showed a slight gain over the preceding week. In all there were 33 new operations reported of which four were wildcat locations. Two of these were in the Pearland area while the other two were in Jackson County. The majority of the locations were reported in the Tomball, Hastings and Friendswood fields, while the balance were divided among Anahuac, Amelia, Hardin, South Call, Blue Basin, Pickett Ridge, Five Corners, West Columbia, Lockridge, Heyser, Dickinson and Fairbanks.

Wildcat locations which have attracted wide attention were made in the Pearland area, Brazoria County, by Albert Plummer and W. H. Christie and others. Plummer has derrick up for his No. 1 G. C. Street, in the H. M. Hunter Survey, while to the southeast in the adjoining survey, W. H. Christie and others are moving in for No. 1 J. J. Settegast. In Jackson County H. J. Porter has spudded his No. 1 Faust while location has been made by Humble Oil & Refining Co. for No. 1 J. R. Davis, southeast of Lolita, Block 150 of the I.&G.N. Survey.



On location in the heart of the Hardin field, Liberty County, this drilling crew of Harry L. Edwards Drilling Co. took time out to have a picture taken. Facing left to right: C. H. Trawick, E. C. Doonell, R. L. Newell, Ray Lynch and C. M. Kelley, (tool pusher)

BASSLER LIQUID METERS



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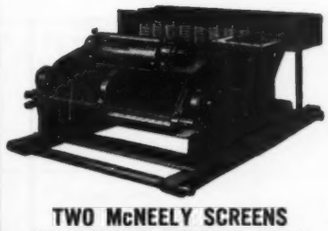

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Oklahoma Operations

By DAL DALRYMPLE

Completion of Three Offset Wells in Ramsey Field Near

The Ramsey pool in Payne County, the new Waukomis area in Garfield County, and the spectacular Cement field of Caddo County shared field interest the past week, even though operations were delayed by severe weather. Feature of activity at Cement was completion of Oklahoma's biggest gas well.

The second well was due to be completed in the Ramsey pool this week, with completion of two others expected to follow in rapid order. Mid-Continent Petroleum Corp. and others No. 1 Brandon, SE SE NE section 13-18-1e, west offset to the discovery well, was bottomed at 4,791 feet in Wilcox sand topped at 4,764 feet. Top of the sand was 3 feet lower than in the discovery well. Cores taken Saturday and Sunday carried saturation. Operators were running tubing preparatory to completion.

Same operators' No. 1 Columbia Wetzel, NW NW SW section 18-18-2e, offsetting the discovery on the south, was at total depth of 4,740 feet, and operators were drilling plugs set at 4,710 feet. Their No. 1 Carl Wetzel, NE NE SE section 13-18-1e, southwest diagonal offset to the discovery, topped Viola lime at 4,690 feet and stopped at 4,730 feet to set pipe. Viola lime in this well was found some 6 feet lower than in the discovery.

Harry Hollenbach and Nels Burton No. 1 Clark, NW cor. section 34-21-6w, showed to open a new pool southeast of Waukomis, in Garfield County, when it cleaned itself after perforating casing early last week. It was bottomed at 7,336 feet in second Wilcox sand, with perforations in Marshall sand zone at 7,260-80 feet. Production was estimated from 300 to 500 bbls. of oil daily, naturally, with 5,000,000 feet of gas. Completion was delayed by inclement weather.

Several tests were under way in Tillman County, southwestern Oklahoma. M. G. Martin No. 1 Parris, section 3-3s-19w, set whipstock at 1,560 feet and was drilling in new hole below 1,840 feet. Originally, it was drilled to 2,135 feet, where drill stem was twisted off. Top of the Canyon formation is expected at around 3,150 feet. Location is 2 miles west of two producers that had Canyon series at around 3,170 feet. Barney Cockburn No. 1 Nichols, SE cor. section 28-2s-19w, was reported to have had oil showing in cores at 3,080-95 feet, but mudded off and was drilling ahead to contract depth of 4,200 feet. The block was assembled with guarantee the well would go to 4,200 feet, regardless of showings at lesser depths. Gibson & Jennings, of Dallas, have moved in tools and were rigging up for a test in SE SE SW section 35-2s-19w, 1¼ miles northwest of production. R. O. Ray's test in NW cor. section 3-3s-18w, carried in field reports as H. I. Grimes and others No. 1 Laney, was at total depth of 3,021 feet, with Canyon lime expected at around 3,065 feet. Should the Canyon series not be productive, it will be drilled to contract depth of 4,800 feet.

Carter Oil Co. started digging pits and cellar at its No. 1 Lydick, in section 23-15-4w, new wildcat in southwestern Logan County, but work was delayed by unfavorable weather.

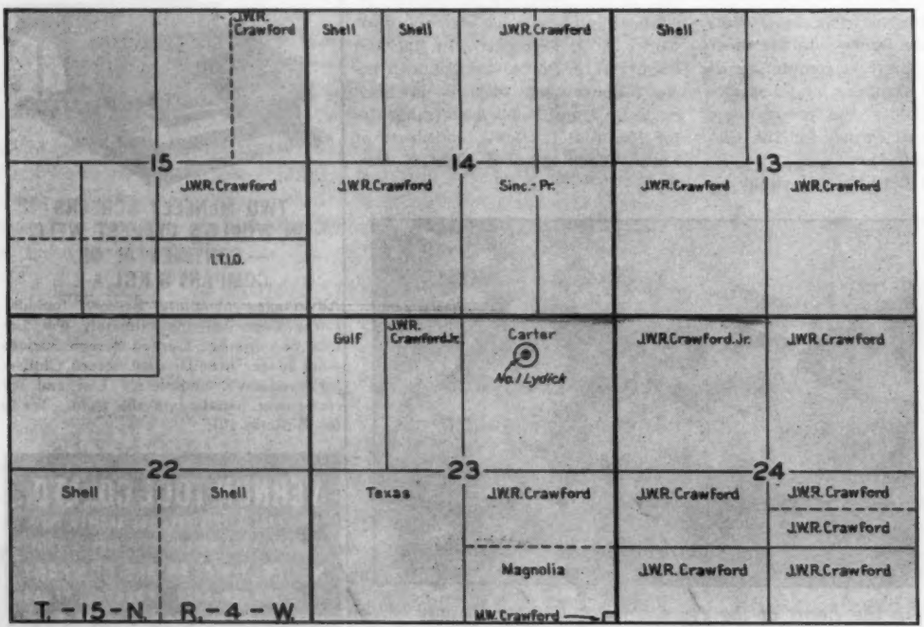
Pontotoc County

Several leases in the lowlands of the Fitts district, Pontotoc County, were under water as a result of recent heavy rains and field activity was reported almost at a standstill. Normal conditions were expected to be restored this week.

Testing of Mid-Continent Petroleum Corp. No. 12 Statler, C N half N half SW section 2-1n-7e, Jesse area, was delayed because of unfavorable weather. It was bottomed at 4,052 feet and was acidized.

Three old Fitts wells were plugged back and recompleted. E. H. Moore No. 12-A Schauers, SE NE NW section 29-2n-7, was plugged back from 4,355 feet to 4,330 feet and pumped 31 bbls. of oil in 12 hours, cutting 2 per cent water.

Same operator's No. 4 Woodruff, NW NW SE section 29-2n-7, was plugged back from 4,403 feet to 4,265 feet. It pumped 90 bbls. of oil and 153 bbls. of water in 24 hours.



Mid-Continent Map Co., Tulsa

Work was started at Carter Oil Co.'s wildcat in section 23-15-4w, Navina district, Logan County, Oklahoma

Loual Drilling Co. and others No. 2-A Harden, SE SW NW section 30-2n-7, at old total depth of 3,650 feet, set Baker plug at 2,700 feet and shot at 2,500-2,580 feet. It flowed 155 bbls. of oil in 12 hours.

Patsy Oil Co. No. 2 Meharg-West, SW SE SW section 21-2n-6, was a rig. W. A. Delaney and others No. 1 Perrine, SE NW NW section 27-5-5, was a location. Garretson & Hembree No. 1 Brown, SE SW NE section 27-5-6, was a derrick.

Seminole County

Five new operations were reported in the Dora area, Seminole County, currently one of the busiest pools in Oklahoma. Winkler & McQueen No. 1 Bruner, NW NW NE section 4-6-6, was a location. Troup & Hall No. 2 Snyder, NE NE NW section 4-6-6, was a rig and had dug pits. J. F. Smith No. 3 Austin, NE NE SE section 32-7-6, had dug cellar and pits. Same operator's No. 4 Norvel, SE SE NE section 32-7-6, was a cellar. J. F. Smith and others No. 2 Harryman B, SW SE SW section 33-7-6, was a rig.

W. B. Pine No. 1-A Wright, SE SE NE section 16-6-6, wildcat, was a rig. Winona-Jarvis-Holm No. 2 Barkus, NW SE SE section 18-7-8, Fish area, had dug cellar and pits. W. C. McBride and others No. 2 Boy Scouts, NE SE SE section 7-9-7, East Seminole pool, was a rig. Wood Oil Co. No. 1 Cudjo, NE SE NE section 2-8-6, was a location in the Seminole district.

Creek County

Lease Investment Co. No. 1-A Allen, NE NW NW section 1-14-10, Creek County, had Wilcox sand at 3,087 feet, total depth 3,113 feet, and pumped 47 bbls. of oil and 25 bbls. of water daily, initially.

Frierson & Kirchner No. 1 Cooper, SW NW SW section 26-14-0, found Misener sand at 3,237 feet, was bottomed at 3,247 feet, and swabbed and flowed 90 bbls. of oil in 24 hours. In the second 24 hours it flowed and swabbed 126 bbls. of oil.

Louis Stekoll No. 1 Walker, SW NE NW section 32-14-10, had a hole full of water and was abandoned at 3,477 feet, total depth.

Lease Investment Co. No. 1 Brooks, NW SW SW section 36-15-10, topped Dutcher sand at 2,503 feet, total depth 3,530 feet. It flowed 124 bbls. of oil in the first 24 hours, 147 bbls. the next 24 hours and 156 bbls. the third 24 hours.

D. W. Franchot and others No. 1 McKellop, SE cor. section 27-16-10, topped Wilcox sand at 3,154 feet, had a hole full of water at 3,166 feet, total depth, and was abandoned.

Strozier Drilling Co. No. 4 Atkins, SW NE SW section 12-16-11, had Dutcher sand at 2,378-2,383 feet, total depth, and pumped 25 bbls. of oil and 5 bbls. of water in 24 hours.

S. W. Anthony No. 4 Gilcrease, NW SE SW section 33-17-12, had a hole full of water in Wilcox sand topped at 2,388 feet and was abandoned at 2,398 feet, total depth.

L. B. Jackson No. 2 Hall, SW SW NE section 26-18-8, had a hole full of water at 2,734-51 feet, total depth, and was abandoned.

Curtis Oil Co. No. 1 Carr, SE NW NE section 26-18-9, pumped 100 bbls. of oil in the first 24 hours from Burgess sand topped at 2,875 feet, and was completed at 2,910 feet, total depth.

Galina Oil Co. No. 1 Anthis, NE cor. section 36-18-10, found Dutcher sand at 2,198 feet, total depth 2,206 feet, and produced 2,750,000 feet of gas.

New work in Creek County: Central Commercial Oil Co. No. 1 Ricks, SE cor. section 16-17-9, moving in machine; Sinclair Prairie Oil Co. No. 3 Wallace, SE SW SW section 24-18-9, cellar and pits.

Deep Rock Oil Corp. No. 14 Peterson, C N half NE

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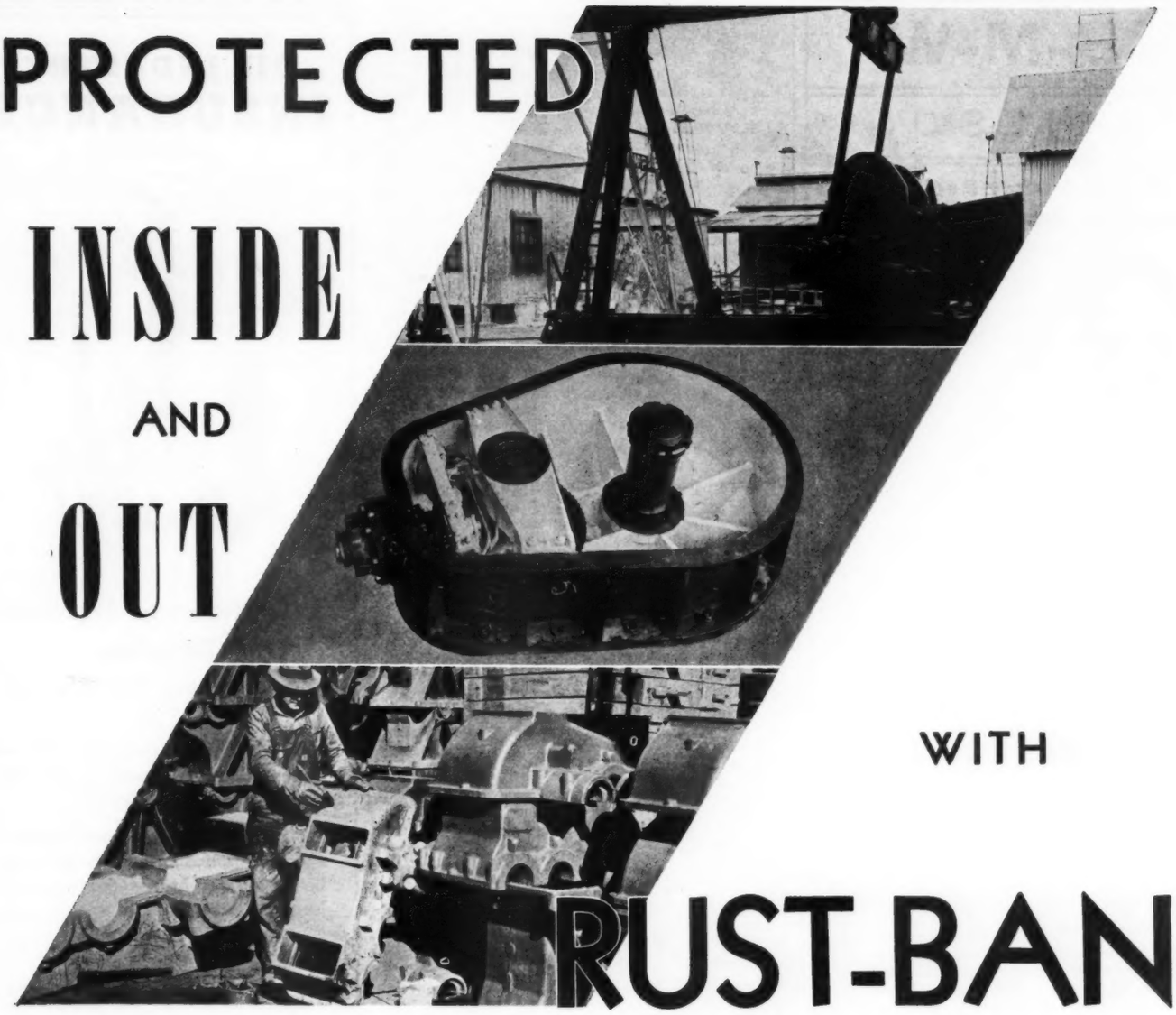

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SW section 33-19-7, an old well, was deepened from 2,470 feet to 2,605 feet, and was abandoned.

Okmulgee County

J. Garfield Buell No. 1 Whitman, SE NW NW section 4-13-11, Okmulgee County, was dry and abandoned at 3,650 feet, total depth.

R. C. Vincent and others No. 3 Wheeler, NE NW SE section 6-13-11, topped Wilcox sand at 3,260 feet, total depth 3,319 feet, where water intruded, and was plugged back to 3,316 feet. It was shot and completed as a 25-bbl. pumper.

A. G. Hazlett No. 1-A Tucker, C E half SW SE section 2-13-14, had Booch sand at 1,255-67 feet and was completed as a 5-bbl. pumper at 1,297 feet.

Tide Water Associated Oil Co. No. 10 Harris A, C W half SW NW section 26-13-14, topped sand at 1,557 feet, total depth 1,603 feet, was shot and pumped 5 bbls. of 36-gravity oil daily.

J. L. Selvy No. 3 Mallory, SE NW NE section 2-14-14, was dry and abandoned at 1,460 feet, total depth.

J. E. Dow No. 10 Spurgeon, NE NW NW section 13-14-14, found Booch sand at 1,036-63 feet, total depth 1,067 feet, and pumped 10 bbls. of oil in 24 hours.

Adams & Riley No. 2 Lee, SW NW SW section 27-15-11, topped Wilcox sand at 1,850 feet, total depth 2,867 feet, was shot and pumped 75 bbls. of oil in 24 hours.

W. B. Pine No. 10 Bassett, C SE SW section 19-14-14, was a location. C. E. Beal and others No. 1 well, SW SW NW section 27-15-11, was a location. G. B. Siebert No. 1-A Rossiter, C NE NW section 31-16-14, was a location.

Estimated Daily Production

Estimated daily production of Oklahoma for the week ending February 19, and for the preceding week, was as follows:

	Barrels	
	Feb. 19	Feb. 12
Allen	5,725	5,750
Billings	7,375	7,600
Burbank	7,600	7,675
South Burbank	13,200	13,400
Balance Osage	19,750	19,650
Blackwell district	5,200	5,150
Bristow-Slick	6,950	6,975
Chandler	2,275	2,350
Crescent	8,175	7,500
Cromwell	3,350	3,325
Cushing-Shamrock	10,600	10,750
Duncan district	3,850	3,900
Edmond	10,400	9,900
Fish	4,475	4,125
Fitts	65,025	64,175
Jesse	3,525	2,950
Graham	5,600	5,600
Gray	1,150	1,175
Healdton	9,300	9,425
Hewitt	4,025	4,050
Holdenville	800	825
Keokuk	8,400	7,750
Konawa	1,575	1,525
Lucien	11,700	11,500
Moore	8,350	7,100
Oklahoma City	117,200	100,000
Olympic	6,475	6,550
Polo	750	750
Sasakwa and townsite	2,400	2,725
Sholem-Alechem	2,950	3,000
Seminole district:		
Bowlegs	10,200	10,525
Carr City	4,450	4,450
Earlsboro	5,925	5,750
South Earlsboro	625	650
East Earlsboro	5,925	6,250
Little River	9,725	9,525
East Little River	1,050	1,025
Maud	725	725
Mission	1,850	1,800
Seminole	8,550	8,625
East Seminole	1,900	1,850
Searight	3,675	3,650
Total Seminole	54,600	54,825
St. Louis-Pearson	18,600	18,250
Tatums	6,875	6,850
Tonkawa-Garber-Thomas	4,400	4,400
Wewoka	2,750	2,750
Yale-Jennings	3,775	3,750
Other pools	83,150	83,150
Total Oklahoma	532,300	511,125

Muskogee County

Robinson Oil Co. No. 1 Murphy, SE SW SE SW section 7-13-16, Muskogee County, had a hole full of water in sand at 2,173-80 feet, total depth, and was abandoned.

First reports of new activity in Muskogee County: Robinson Oil Co. staked location for a well in NE SW SE section 18-13-16; J. L. Parks No. 1 Hilderbrand, SW NW SE section 17-14-19, was a location; Oklahoma Natural Gas Co. No. 4 Evans, NW SW SE section 32-14-19, was drilling below 90 feet.

Wagoner County

Illinois Refining Co. and J. H. Dillard No. 1 Carhart, SW SE SW section 17-17-15, Wagoner County, found Arbuckle lime at 1,866 feet, was bottomed at 1,882 feet, and was acidized with 2,000 gallons. It pumped 150 bbls. of oil and 200 bbls. of water in 24 hours, completed.

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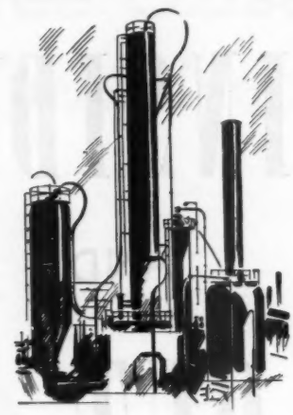

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Conrad Lambert No. 1 Mingo, NW NE NW section 20-17-15, had Arbuckle lime at 1,869 feet, total depth 1,886 feet, was acidized and pumped 25 bbls. of oil and 75 bbls. of water daily.

Sands Petroleum Co. No. 1 Okemah, SE NW NE section 22-17-16, Wagoner County, had sand at 858 feet, total depth 875 feet, and pumped 10 bbls. of oil daily.

Garvin County

Simpson-Fell Oil Co. and others No. 10 Derdyn, C W half SE NW section 17-1n-3w, Robberson pool, Garvin County, perforated casing at 1,470-1,700 feet, and was completed as a 25-bbl. pumper at 1,824 feet, total depth.

Carter County

K. O. T. Oil Co. No. 7 Westheimer A, NE cor. section 35-4s-2w, an old Carter County well, was deepened from 2,857 feet to 2,972 feet, total depth, and pumped 29 bbls. of oil the first 24 hours.

Magnolia Petroleum Co. No. 74 Richards, NE NE NW section 6-4s-3w, an old well, was plugged back from 1,153 feet to 1,136 feet, was shot and produced 52 bbls. of oil and 11 bbls. of water daily. Originally, it was completed for 13 bbls. of oil and 78 bbls. of water.

Sun Oil Co. No. 18 Mullin A, NW SW NE section 4-4s-3w, Healdton pool, was rigging up machine. Carl Carter No. 1 McClish, SE SW NE section 19-2s-3w, Milroy shallow pool, was a machine.

Jefferson County

Bridwell Oil Co. No. 5 Seay, NE NE SW section 30-6s-5w, Oscar-Seay district, Jefferson County, was dry and abandoned at 2,091 feet, total depth, in lime.

Caddo County

Magnolia Petroleum Co. completed No. 10 Niles, SW SW NW section 36-6-10w, on the west side of the Cement field, Caddo County, as one of the largest gas producers in Oklahoma. It gauged 203,500,000 feet of gas, producing from the Deese formation, and was shut in. Rock pressure was 1,650 pounds. It had sand at 4,310-30 feet, shale 4,330-60 feet, sand 4,360-70 feet and Conglomerate 4,370-4,450 feet, total depth.

Magnolia Petroleum Co. No. 6 Hedlund, SW NW NE section 11-5-9w, an old Cement well being deepened from 3,834 feet, was drilling at 3,849 feet.

Osage County

Sinclair Prairie Oil Co. No. 9 Osage, SW SW SE section 9-25-6, South Burbank area, Osage County, had Burbank sand at 2,786 feet, total depth 2,808 feet. It was completed for flowing potential of 487 bbls. of oil daily.

D. B. Mason and Ohio Oil Co. No. 6 Osage, NW SE SW section 3-24-12, had Bartlesville sand at 1,542-66 feet, total depth, was shot and completed as a 15-bbl. pumper.

E. H. Green No. 7 Osage, SE NE NE section 11-21-11, found Burgess sand at 1,893-1,906 feet, total depth, and pumped 8 bbls. of oil daily.

Pawnee County

Johnson Oil Refining Co. No. 4 Beyl, NW SE NE section 27-20-9, Pawnee County, had Red Fork sand at 2,114-45 feet, total depth 2,175 feet, and swabbed and flowed 136 bbls. of 38-gravity oil daily, completed.

J. V. Dunbar No. 1 Gibbins, SW cor. section 8-20-9, was dry and abandoned at 1,601 feet, total depth.

R. E. List No. 1 Stockton, SE cor. section 9-21-8, was a location.

Wildcat Completions

Phillips Petroleum Co. No. 1 Wood, NW SW SW section 31-11-13, Okmulgee County wildcat, topped Wilcox sand at 3,885 feet and was dry and abandoned at 3,888 feet, total depth.

H. F. Potts No. 1 Johnson, SE cor. section 10-1s-2w, Carter County wildcat, had a hole full of water and was abandoned at 737 feet, total depth.

Indian Territory Illuminating Oil Co. No. 1 Drum, C N half SW NW section 32-2s-17w, Tillman County wildcat, had Canyon series at 2,962 feet, Conglomerate 3,841 feet, water intruded and it was abandoned at 3,843 feet, total depth, in Conglomerate.

Scattered First Reports

The following new activity was reported for the first time:

In Logan County, Magnolia Petroleum Co. No. 1 School Land, NE NW SE section 14-17-1w, Langston pool, was a location.

In Pottawatomie County, Magnolia Petroleum Co. No. 6 Banta, NW SE NE SE section 14-7-4, St. Louis area, was rigging up rotary; Stanolind Oil & Gas Co. and Amerada Petroleum Corp. No. 6 Rushing, SW NW SE section 32-11-4, Shawnee pool, was a location.

In Garfield County, Sinclair Prairie Oil Co. No. 29 Walker, SE SW SE section 24-22-4w, Garber pool, was a location.

In Oklahoma County, Ohio Oil Co. No. 5 Fortson, SE SW NE section 24-11-3w, Oklahoma City pool, swabbed 166 bbls. of oil in 11 hours and was testing after plugging back from 6,080 feet to 3,338 feet and perforating casing.

In Lincoln County, Skelly Oil Co. No. 2 Erwin, SE SW SW section 35-15-2e, Wellston pool, was building rig; Sinclair Prairie Oil Co. No. 4 Hoyt, SE NW NE section 5-14-3e, Hoyt pool, was a location; Helmerich & Payne No. 5 Fitch, NW SW NE section 15-14-6, was moving in rotary; Buell & Herndon No. 1 Fouquet, C W half SE section 9-13-6, Lafoon area, was a rig.

(Continued on Page 251)

Double-crank geared power on 3,100-foot well in the Little River extension south of Seminole, Okla.

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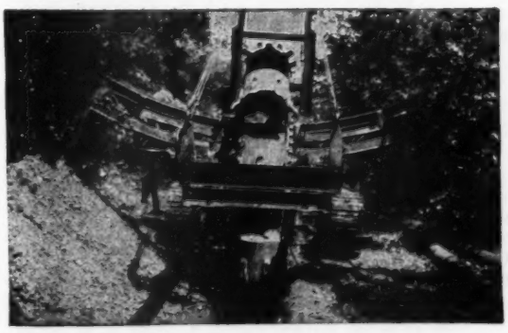

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CLEVELANDS

North and East Texas

By MITCHELL TUCKER

K.M.A. Operators Going Far Afield With Their Outposts

WICHITA FALLS, Tex., Feb. 21.—With a total of 144 wells either rigging up, drilling, or in the process of completion, the K.M.A. field of southern Wichita and northern Archer counties remains, for the second week, the world's most active drilling field. During the past week 21 new locations were staked.

A new wildcat for the northeast side of the pool was announced by E. S. Graham of Chickasha, Okla., who staked his No. 1 E. M. Goetze, in the SW quarter of section 2, Washington County Survey, Abstract 444. It is 2½ miles northwest of Tom Medders No. 1 Edith Fields, in section 32, H.&G.N. Survey, Abstract 415. This outpost is almost 7 miles due north of production on the extreme northeast corner of the pool.

Location for a new outpost on the east side of the pool, but south of the river, was staked by M. T. Flannagan and the Modisett Drilling Co. for No. 1 Texas Mortgage Co., 330 feet from north and west lines of section 1, J. McCool Survey, Abstract 192, Palo Pinto County School Lands.

F. W. Merrick and Target Drilling Co. No. 1 Cranfill-Waggoner, extreme northwestern outpost located in section 35, Block 5, H.&T.C. Survey, Abstract 771, was coring in hard lime below 3,745 feet and showing no saturation. This test is about 4 miles northwest of the Joe A. Worsham No. 1 Waggoner, on the northwest corner of the pool.

King Oil Co. and Cullum & Perkins No. 1 Burnett, section 2, W. W. Carroll Survey, Abstract 434, 1½ miles north of production on the east side of the pool, was drilling below 4,040 feet in hard lime, without any showing. The Kemp City lime was topped at about 3,960 feet.

On the northeast side of the pool, Heyser, Heard & Clardy No. 1 Fassett is bottomed in sand at 4,006 feet and samples showed salt water on laboratory tests. Top of lime is 3,814 feet with saturated lime logged at 3,991 feet to 4,006 feet.

Big Lease Deal

One of the largest lease deals in recent weeks was completed between Wheeler Nazro of Houston and Chapman & McFarlin of Tulsa. Nazro sold his 83-acre lease in the south half of Block 3, F. Peterswick Survey, Abstract 243, on the southeast edge of the pool, just across the line in Archer County, for $750 cash and $1,250 in oil per acre, making a total of $2,000 an acre. In addition, Chapman & McFarlin repaid Nazro for the one producer already drilled and also repaid expenditures on the second drilling well. Nazro is to retain all the oil run from the lease prior to consummation of the sale.

British American Oil Producing Co. of Tulsa continued to add to its holdings in the northern part of the pool last week. The company paid $700 an acre, half cash and half oil, for approximately 120 acres in about the middle of the B.S.&F. Survey, Abstract 744, from N. H. Martin. The lease lies about a half mile south of the Joe A. Worsham No. 1 Waggoner, northwest extension well.

Jack County

Danciger Oil & Refineries, Inc. completed No. 2 Ivey to give the Bryson pool of southwestern Jack County a further extension to the northeast. The Danciger well proved to be one of the biggest completions in the Bryson pool, when it came in with 115 bbls. of oil natural flow, the first hour, then diminished to a steady flow of 50 bbls. per hour. This test is northeast of the same operator's No. 1 well.

Location for Jack County's newest deep prospect was announced. It will be the Butler & Horn and Simons No. 1 C. C. Henderson, in the center of a 95-acre tract in the S.P. Survey No. 565, about 12 miles north of Jacksboro. Operators' block consists of 1,800 acres and contract depth will be 3,500 feet.

The railroad commission ordered a hearing to be held in Fort Worth on February 24 for determining the need of special regulations in the East Bryson area of the Jack County oil pool. Officials said special emphasis would be placed on the spacing program in the W. M. Bryan, Thomas M. League, Mary Hamilton and B.S.F. Railway surveys.

Wilbarger County

A new Canyon lime oil pool was in prospect for northeastern Wilbarger County with a reported showing in the Phillips Petroleum Co. No. 1 Waggoner-Barger, 1,200 feet from south and west lines of section 11, Block 14, H.&T.C. Survey. A well saturated section of the Canyon lime was topped at 2,849 feet and carried to 2,857 feet, where the well is bottomed. This wildcat, 4 miles southwest of Harrold, is in a heretofore unproductive horizon in that part of the county.

EASTERN TEXAS FIELDS

DALLAS, Tex., Feb. 21.—The search for additional Woodbine structures in Eastern Texas continues at a steady pace, even though disappointing results have been had in practically every deep Trinity prospect drilled throughout this territory in the last year. A few of the major wildcats with Woodbine sands as their objectives include the following: J. T. Harper and White No. 1 L. S. Harper, in the W. N. Dawson Survey, 8 miles southwest of Talco, which is rigging up; Peyton Brothers No. 1 C. P. Daniels, in the Jose M. Procella League, 1 mile north of the town of Percilla, in Houston County, which has finished spudding in; Tom Mayberry No. 1 W. W. Wilson, G. W. Wilson Survey, northeast of Augusta, Houston County, and C. W. Killough No. 1 Marry Price, T. Strother Survey, 5 miles west of Grapeland, also in Houston County, both of which will start operations soon. De-Arman & McMillian and Sherman Hunt No. 1 J. M. Dowdy, in the Tool area of Henderson County is now testing the Woodbine at 3,095-3,103 feet. Lone Star Gas Co. No. 1 Melasky, in the Buffalo gas area of Leon County, is drilling in chalk below 5,063 feet. Orchard & Biddle No. 1 Gibson, 6 miles west of Rural Shade in Navarro County, is drilling ahead, with top of the Woodbine expected at 3,700 feet.

Buffalo Field Pipe Line

Lone Star Gas Co. has completed an 18-mile pipe line extension in Leon County to serve as an outlet for its gas wells purchased from Shell Petroleum Corp. in the Buffalo field. The 18-mile extension ties in with the company's 12-inch carrier extending from the Long Lake field to Central Texas cities.

Limestone County

Stanolind Oil & Gas Co. has finished running 8,727 feet of streamlined 7-inch O.D. casing in its No. 1 Tenny Norris, K. Thrasher Survey, deep wildcat test in the Thornton Fault area of Limestone County. The test was bottomed at 8,727 feet in a highly porous section of dolomitic lime, said by some to be Upper Permian and by others to be still a part of the Lower Marine Trinity.

Talco Deep Test

Operations were well under way on the deep Trinity exploratory test in the Talco field of Franklin County last week. The test is in the C. Paine Survey about 1 mile west of the town of Talco. Expecting to cut the fault within 100 feet operators at Ajo Oil Corp. No. 1 Saunders were reported drilling past 4,500 feet. Operators expect to find saturation logged in Magnolia No. 2 Chapman, deep failure, around 5,600 feet. The well is being deepened from a previously abandoned dry hole at 4,371 feet.

Kelsey Dome

On the Kelsey dome in Upshur County, Tom Hunter and American Liberty Oil Co. No. 1 J. P. Carter are drilling shale and lime at 7,430 feet and expected to start coring for the Pettit lime soon. The test is in the J. H. Fields Survey and has a contract depth of 9,000 feet to be carried into the Lower Marine Trinity.

EAST TEXAS FIELD COMPLETIONS

(24-hour gauges)

Gregg County—Longview Area

Atlantic Oil & Refining Co. No. 9 Castleberry, 3,584-3,675 feet, 54 bbls. General American No. 6-B Bumpas, 3,505-15 feet, 80 bbls. Humble Oil & Refining Co. No. 19 Killingsworth, 3,583-6,319 feet, 60 bbls.; No. 11-A Sheppard, 3,640-77 feet, 59 bbls. Magnolia Petroleum Co. No. 17 Todd-Stinchcomb, 3,553-68 feet, 100 bbls. Margay Oil Co. No. 12 T. Christian, 3,648-56 feet, 94 bbls. Shell Petroleum Corp. No. 24 H. Hampton, 3,610-45 feet, 60 bbls. Sinclair Prairie No. 20-B Aiken, 3,526-86 feet, 40 bbls. Stanolind Oil & Gas Co. No. 8 R. Christian, 3,590-3,667 feet, 51 bbls.; No. 59-B J. C. and R. S. McKinley, 3,601-55 feet, 50 bbls. Sun Oil Co. No. 28 Aiken, 3,513-50 feet, 60 bbls.; No. 39 Haynes, 3,578-3,658 feet, 60 bbls. Tide Water No. 19 A. F. Sheppard, 3,638-68 feet, 60 bbls.

Gregg County—Kilgore Area

Jess Bod Oil Co. No. 3 M. E. Anderson, 3,512-35 feet, 3 bbls. General American No. 19 J. Douglas, 3,661-63 feet, 40 bbls. General Crude No. 12 S. Scott, 3,645-55 feet, 57 bbls. Gulf Oil Corp. No. 5 W. B. Goyne, 3,605-12 feet, 60 bbls. T. L. James & Co. No. 2 James, 3,515-36 feet, 11 bbls. T. W. Lee No. 3-B J. R. Carter, 3,587-90 feet, 40 bbls. Magnolia Petroleum Co. No. 38 Radford, abandoned location; No. 14 N. Radford, 3,613-21 feet, 96 bbls. Potter Brothers No. 2 Kilgore Col. Ch., 3,530-45 feet, 22 bbls. M. E. Tropp No. 5 J. King, 3,540-75 feet, 40 bbls. Roosth-Genecov No. 2 J. Young, 3,522-40 feet, 30 bbls.

Rusk County—Kilgore Area

Gulf Oil Corp. No. 10 R. N. Brightwell, 3,622-40 feet, 20 bbls. Houston Oil Co. No. 6 E. Thompson, 3,641-75 feet, 80 bbls. Humble Oil & Refining Co. No. 20-A J. T. Sexton, 3,633-90 feet, 60 bbls. Stanolind-Crosby No. 12 Powers, 3,680-81 feet, 57 bbls.

Rusk County—Joiner Area

Arkansas Fuel Oil Co. No. 19 Wheelis, 3,623-49 feet, 54 bbls. Champlin-Bass No. 6 Alford, 3,748-68 feet, 54 bbls. Ebony Oil Co. No. 10 B. F. and A. J. Deason, 3,654-85 feet, 50 bbls. W. Fleming No. 3 H. Brooks, 3,612-65 feet, 50 bbls. General American No. 13 Thompson, 3,737-50 feet, 72 bbls. Humble Oil & Refining Co. No. 12 J. D. Florey, 3,680-83 feet, 80 bbls.; No. 20 Gervin, 3,673-80 feet, 75 bbls.; No. 8 Williams, 3,628-3,708 feet, 65 bbls. Magnolia Petroleum Co. No. 8 W. B. Kee, dry and abandoned at depth of 3,690 feet. Marr Drilling Co. No. 7-A G. Gossett, 3,670-72 feet, 10 bbls. M. S. Massard and others No. 2 Cooper-Cansher, 3,688-3,704 feet, 60 bbls. Ohio Oil Co. No. 85 M. M. Cross, 3,612-40 feet, 36 bbls. Tide Water Oil Co. No. 24 Pinkston, 3,745-75 feet, 60 bbls.

Upshur County

Dean & Phillips No. 1 Monk, 3,713-14 feet, 80 bbls. General American No. 15 T. Wells, 3,724-26 feet, 120 bbls. Monte Oil Co. No. 9 Smith, 3,678-81 feet, 60 bbls.; No. 10 Smith, 3,664-73 feet, 50 bbls. W. R. Nicholson No.

(Continued on Page 259)

Kansas Developments

By
DAL DALRYMPLE

Open New Producing Areas in Barton, Cowley Counties

Discovery of new producing areas in Barton and Cowley counties and an indicated extension of the Sittner pool of Stafford County were features of the past week in Kansas. Field activity was retarded throughout the state by heavy snows and blocked roads, but at the weekend resumption of work at most outposts was reported.

Texas Co. No. 1 Lowry, CNL NW SW section 2-17-13w, wildcat northeast of Hoisington in Barton County, found Arbuckle lime at 3,323 feet, had oil showing at 3,335-40 feet, with best pay at 3,340-41 feet, and was bottomed at 3,342 feet. It tested 10 bbls. of oil in seven hours after acidizing. It was deepened to 3,350 feet, the oil increased and it was reacidized and waiting for test.

Arthur Brewer No. 1 Clark, NE SE NW section 6-31-4e, about 9 miles north of Winfield in Cowley County, was reported to have 500 feet of oil in the hole from Bartlesville sand at 2,856-79 feet. Operators were to set pipe for completion. It opens a new producing area for the old Clark pool.

Torrey & Feaster No. 1 Mueller, SE cor. section 29-21-12w, one-half mile northwest of production in the Sittner pool, Stafford County, found saturation in Arbuckle lime at 3,594-3,600 feet. Operators set 7-inch casing and were due to test this week. If completed as an oil well will be the fourth producer for the pool and will open a considerable area to development. It is on a Stanolind Oil & Gas Co. farmout.

Producers and purchasers in Kansas will meet with the Corporation Commission in Wichita February 24 to discuss allowable production for March. The Bureau of Mines estimated a market demand of 176,700 bbls. for Kansas oil in March, an increase of 300 bbls. of the February **allowable.**

Wildcat Completions

The only wildcat discovery well completed the past week was Cities Service Oil Co. and others No. 1 Schroeder, CNL N half NW section 29-17-9w, between the Lorraine and Heiken areas in southwestern Ellsworth County. After acidizing with 3,000 gallons it made potential of 2,644 bbls. of 38.8-gravity oil. Top of Kansas City lime was 2,865 feet, Conglomerate 3,185 feet, Simpson sand 3,200 feet, Arbuckle lime 3,205 feet, total depth 3,215 feet. Other operators interested in the wildcat are Carter Oil Co., Skelly Oil Co., Continental Oil Co. and Texon Oil Co.

Other wildcat completions of the week were failures. C. L. Carlock and associates No. 1 Gates, SE SW NE section 34-22-11w, Stafford County, had Arbuckle lime at 3,660 feet, total depth 3,669 feet, and was dry and abandoned.

Fred Rust and associates No. 1 Hullman, SW cor. section 5-22-12w, Stafford County, was dry and abandoned at 3,841 feet, total depth. Arbuckle lime was topped at 3,832 feet.

Clyde Pulse and others No. 1 Payne, SW NW NE section 4-22-7w, an old wildcat in Reno County, was deepened from 3,440 feet to Arbuckle lime at 3,872 feet, total depth 3,889 feet, and was dry and abandoned.

Skelly Oil Co., Kimmell & Stewart No. 1 Gorham, SW SW SE section 32-25-10w, Reno County, had Arbuckle lime at 4,387 feet and was dry and abandoned at 4,403 feet, total depth.

Cohen and others No. 1 Teter, SE SE SW section 3-23-5w, Reno County, was an abandoned location.

Dickey Oil Co. No. 1 Kansas Gas & Electric Co., NE cor. section 22-34-3e, Cowley County, found Arbuckle lime at 3,735-90 feet, total depth, and was dry and abandoned.

Russell County

One of the larger producers of the week was completed at R. H. Shields and others No. 4 Letsch, NE SE SE section 27-14-13w, Letsch area, Russell County. Kansas City lime was topped at 2,809 feet and the hole was bottomed at 2,859 feet. After acid treatment, it pumped and flowed 818 bbls. of oil in the first four hours, 757 bbls. in the next four hours and made potential of 4,543 bbls. of oil.

Skelly Oil Co. No. 1 Colliver, NE NE SE section 28-14-13w, topped Kansas City lime at 2,682 feet, total depth 2,909 feet, was acidized and made daily potential of 1,594 bbls. of oil.

National Refining Co. No. 4 Reinhardt D, NE SE NE section 19-14-14w, made potential of 471 bbls. of oil after acidizing. Top of Kansas City lime was 3,033 feet, with pay at 3,070-75 feet, total depth.

Central Petroleum Co. No. 2 Dortland A, SW NW NW section 4-14-15w, found Kansas City lime at 3,048 feet, was bottomed at 3,078 feet, acidized and made potential of 380 bbls. of oil.

National Refining Co. No. 3 East Reinhardt, NE NW NE section 36-14-15w, made potential of 468 bbls. of oil from Arbuckle lime at 3,165-78 feet, total depth.

Carter Oil Co. No. 1 Detrich, SW cor. section 8-15-13w, an old well, was deepened from 2,980 feet to Arbuckle lime at 3,206 feet, total depth 3,211 feet, and made potential of 1,750 bbls. of oil.

New work in Russell County: Phillips Petroleum Co. No. 1 Carrie, SE SE NE section 18-14-14w, Vaughn K. C., building rotary rig; Cities Service Oil Co. No. 9 Strecker A, SW SE SW section 35-14-14w, Gurney South, rigging up rotary; J. C. Shaffer, Inc., No. 6 Cram, NW NE SE section 11-14-15w, set 7-inch casing at 3,035 feet on top of Kansas City lime, rigging up standard tools; same operator's No. 7 Cram, SW NE SE section 11-14-15w, Gorham area, building rotary rig; Brunson No. 1-A Gaynor, SE SE NW section 19-13-14w, drilling below 430 feet; Texon No. 5 Letsch, C E half W half SW section 26-14-13w, location; Magnolia Petroleum Co. No. 2 Rogg, SW SW NE section 27-14-13w, moving in rotary tools; Wakefield and others No. 1 Boxberger, SW SW NW section 6-14-14w, location; Simpson Oil Co. and others No. 1 Boxberger, NE SE NW section 10-15-14w, machine.

Barton County

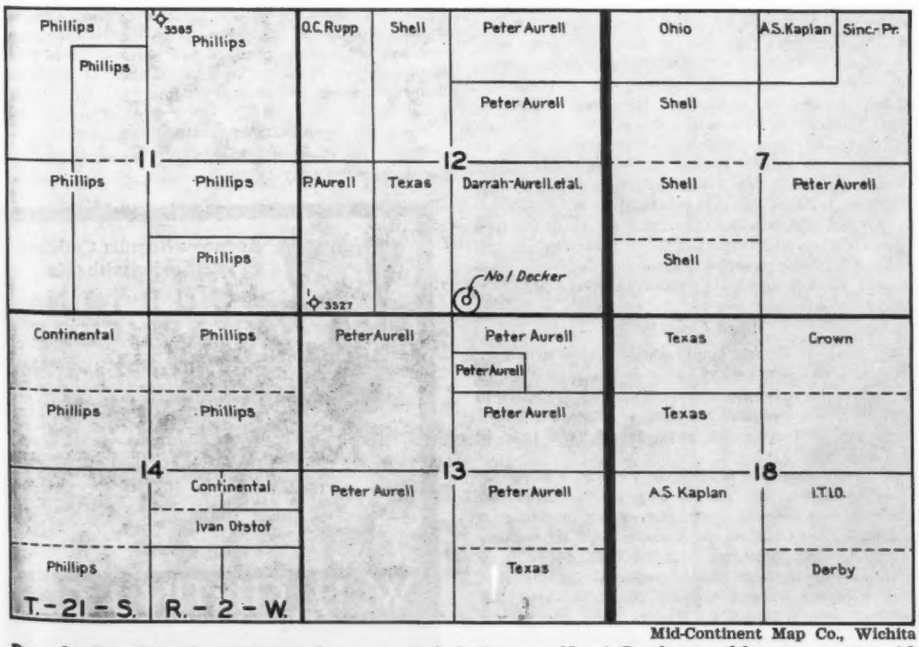
Magnolia Petroleum Co. No. 3 Roetzel, SE NW NE section 25-20-11w, Silica South sector, Barton County, found Arbuckle lime at 3,250 feet, total depth 3,261 feet, pumped 270 bbls. of oil in four hours and made potential of 1,589 bbls. of oil.

Stanolind Oil & Gas Co. No. 3 Stueckemann, NE NE NE section 11-20-11w, made potential of 1,103 bbls. of oil after shooting and acidizing. Top of Arbuckle lime was 3,280 feet, total depth 3,292 feet.

Gulf Oil Corp. No. 1 Nicholas, NW SW NW section 12-20-11w, found Arbuckle lime at 3,272 feet, was bottomed at 3,281 feet, swabbed 211 bbls. of oil in six hours, was acidized and made potential of 1,774 bbls. of oil.

Same company's No. 2 Nicholas, SW SW NW section 12-20-11w, swabbed 217 bbls. of oil in four hours and made potential of 1,949 bbls. Arbuckle lime was found at 3,275 feet, total depth 3,282 feet.

New work in Barton County: Magnolia Petroleum Co. No. 5 Anna Roetzel, NW SW NE section 25-20-11w, Silica South, cellar; Paul Martin and others No. 1 Kultgen, SE SE NW section 16-16-12w, Beaver area, cellar; Cities Service Oil Co. No. 1 Stoskopf, NE NE NW section 17-16-13w, Trapp South, rigging up rotary; Shell Petroleum Corp. No. 1 Schneider B, SE NE SE section 3-16-14w, Trapp Southwest, drilling below 423 feet; Shell Petroleum Corp. No. 1 Bitter A, NE cor. section 11-16-14w, Trapp South, building rotary rig; Silverstine & George No. 1 Otte, SE SE NW section 2-19-14w, wildcat, moving in material; Sinclair Prairie Oil Co. No. 1 Frederick, SW SW SE section 16-16-11w, spudded; T. C. Johnson No. 6 Bitter, SE SE SW section 8-16-13w, rig; Shell Petroleum Corp. No. 1 Burmeister, SW NW SE section 3-17-11w, rigging up rotary; Skelly Oil Co. No. 1 Grosshardt, NE cor. section 15-17-11w, rig; Bennett and others



Mid-Continent Map Co., Wichita

Darrah, Aurell and associates have started drilling at No. 1 Decker, wildcat in section 12-21-2w, McPherson County, Kansas

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No. 3 Steckel, SE SE SW section 1-20-11w, cellar and pits; Simpson-Noble and others No. 1 Dick, NE NW NW section 3-20-11w, rig; Gulf Oil Corp. No. 3 Nicholas, NW NW SW section 12-20-11w, rig.

Estimated Daily Production

Estimated daily production of Kansas for the week ending February 19, and for the week preceding, was as follows:

	Barrels	
	Feb. 19	Feb. 12
Oxford City	2,400	2,300
Burrton	11,075	11,275
Ritz-Canton	6,575	6,600
Graber	3,025	2,250
Hollow-Nikkel	3,400	3,500
Lerado	1,375	1,375
Voshell	2,950	3,000
Wellington	2,550	2,500
Ellsworth County:		
Lorraine	2,900	2,300
Other pools	1,300	1,305
Rice-Barton counties:		
Bloomer	3,250	2,625
Chase	5,675	5,725
Geneseo	2,625	2,300
Raymond	1,025	1,575
Silica	16,100	15,425
Silica—South	2,950	2,650
Keesling	975	750
Wherry	3,675	4,625
Miscellaneous Rice	3,875	3,925
Miscellaneous Barton	3,950	4,940
Russell County:		
Fairport	1,930	1,995
Gorham	1,770	1,630
Russell	1,900	1,470
Sullivan	5,825	6,875
North Trapp	9,030	9,170
Miscellaneous Russell	7,840	7,665
Sedgwick County:		
Valley Center	1,045	1,070
Miscellaneous	3,000	2,950
Ellis County:		
Bemis	6,575	5,675
Miscellaneous	3,490	3,120
Kingman County	480	635
Stafford County	3,665	3,135
Greenwood County	9,700	9,750
Butler County	16,050	16,000
Other fields	24,850	27,215
Total Kansas	178,800	179,300

Ellis County

Four producers were completed in the Bemis-Cress district in northern Ellis County. Lario Oil & Gas Co. No. 1 Pearl, NE SE SE section 13-11-17w, had Arbuckle lime at 3,409 feet, total depth 3,415 feet, was acidized and made potential of 2,043 bbls. of oil.

Murphy Oil Co. and others No. 1 Rumsey, SW NW SW section 23-11-17w, made potential of 2,829 bbls. of oil from Arbuckle lime at 3,361 feet, total depth 3,366 feet.

Shell Petroleum Corp. No. 3 Rumsey, NW SW NW section 23-11-17w, found Arbuckle lime at 3,398 feet, made potential of 2,331 bbls. of oil and was completed at 3,422 feet, total depth.

Cities Service Oil Co. No. 6 Hall B, SE NW NW section 26-11-17w, topped Arbuckle lime at 3,406 feet, total depth 3,413 feet, and made potential of 2,708 bbls. of oil.

The following new operations in Ellis County were reported: Sinclair Prairie Oil Co. No. 3 Romine, NW SW SW section 7-11-16w, Cress area, rigging up rotary; Cities Service Oil Co. No. 1 Rumsey, NW NW SW section 23-11-17w, Bemis, location; same company's No. 9 Hall B, NE SW NW section 26-11-17w, cellar; Bradley Oil Co. and others No. 1 Dickinson, SE cor. section 15-12-16w, Blue Hill area, rotary rig; Sinclair Prairie Oil Co. No. 4 Cress, SW SE NE section 13-11-17w, pits; Magnolia Petroleum Co. No. 11 Johansen, NE NE SE section 22-11-17w, rig; Murphy Oil Co. and others No. 2 Rumsey, SE NW SW section 23-11-17w, location; Deep Rock Oil Corp. No. 28 Baumer, NE NE SE section 27-11-17w, spudded; Western Kansas Oil & Refining Co. No. 1 Cole, NE SE SE section 24-11-20w, location; Carter Oil Co. No. 1 Foster, SE SE NW section 1-15-16w, location.

Rice County

Continental Oil Co. and others No. 1 Williams, NE NE NW section 13-18-8w, Geneseo district, Rice County, found Arbuckle lime at 3,151 feet, total depth 3,238 feet, and swabbed 220 bbls. of oil in 3½ hours. It was acidized and made potential of 2,612 bbls. of oil.

Frank Hollow and others No. 1 Stout, NE SE NE section 6-18-10w, had Kansas City pay at 3,035 feet and was bottomed at 3,054 feet. After acidizing, it flowed 593 bbls. of oil in 3 hours and 15 minutes and made daily potential of 2,304 bbls. of oil.

Operations in Rice County reported for the first time: Republic Natural Gas Co. No. 2 Deweese, SW SW NW section 32-20-7w, Wherry area, rigging up rotary; Mid-Plains Oil Co. No. 4 Hauschild, SE NW SE section 10-21-7w, moving in material; Sinclair Prairie Oil Co. No. 7 Bolton, NE SW SW section 31-18-7w, pits; Continental Oil Co. and others No. 3 Pickerill, SE SW SE section 13-18-8w, location; Continental Oil Co. No. 1 Warner A, SE SE NW section 36-18-8w, location; Cities Service Oil Co. No. 1 Habiger, SW SW NW section 18-18-9w, set 10-inch at 224 feet; Bridgeport Machine Co. No. 1 Habiger, SE NW NW section 5-18-10w, pits; Mid-Continent Petroleum Corp. No. 9 Hartle, NE SE SW NW section 15-20-9w, pits; Reserve Development Co. No. 2 Heter, NE SE NE section 1-21-8w, set 10-inch casing at 101 feet.

McPherson County

Continental Oil Co. and associates No. 6 Huxman, NE NW NW section 29-21-1w, Graber pool, McPherson County, found Wilcox sand at 3,398 feet, total depth 3,413 feet, plugged back to 3,343 feet and was shot and acidized. It made potential of 582 bbls. of oil from Hunton lime topped at 3,268 feet.

T. C. Johnson and others No. 4 Shaw, NW NE SW section 21-19-1w, Ritz-Canton field, was shot and made potential of 237 bbls. of oil, completed. Top of Wilcox sand was 3,405 feet, total depth 3,427 feet.

New work in McPherson County: Carter Oil Co. No. 1 Nelson, E E half NE SE section 7-17-3w, Lindsborg area, location; Jess Cling and others No. 1 Unruh, C NW SW section 25-19-2w, Ritz-Canton, rigging up; Continental Oil Co. No. 1 Meyers, SE SE NW section 20-21-1w, Graber, building rotary rig; same company's No.3 Boechner A, SW SW NW section 28-21-1w, cellar; E. B. Shawver No. 1 Legree, SE cor. section 17-19-1w, was at old total depth of 3,385 feet, to deepen; Darrah, Aurell & Williams No. 1 Decker, SW SW SE section 12-21-2w, wildcat, drilling below 750 feet.

Stafford County

Arbuckle lime production was uncovered in the Sittner pool, Stafford County, at Stanolind Oil & Gas Co. No. 1 Walker, NE NE SW section 33-21-12w. Top of Arbuckle was 3,622 feet, total depth 3,625 feet. After treating with acid, it pumped 280 bbls. of 39.9-gravity oil in four hours and made potential of 1,638 bbls. Other wells in the pool produce from Lansing-Kansas City lime.

Stanolind Oil & Gas Co. No. 1 Hainke, NE cor. section 5-22-12w, had Arbuckle lime at 3,655 feet and was dry and abandoned at 3,659 feet, total depth.

Lario Oil & Gas Co. and others No. 1 McNaughten Loan Co., SW cor. section 22-24-13w, was dry and abandoned in Arbuckle lime at 4,150-54 feet, total depth.

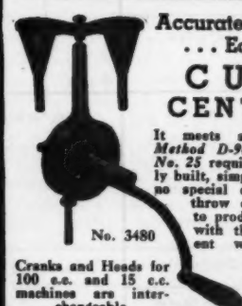
First reports of new activity in Stafford County: Royal Oil & Gas Corp. No. 1 Sittner, NW NW SE section 33-21-12w, Sittner area, drilling below 2,080 feet; Fred Rust No. 1 Krankenberg, NW cor. section 20-22-12w, wildcat, moving in material; Continental Oil Co. and others No. 1 Fair, C N half N half SW section 12-25-13w, wildcat, location.

Sedgwick County

Continental Oil Co. No. 5 Goodrich, NW NW SW section 16-25-1e, Goodrich pool, Sedgwick County, found dolomite at 3,328 feet, total depth 3,330 feet, and was acidized. It pumped 183 bbls. of oil in four hours and made potential of 513 bbls. of oil with water estimated at 30 bbls. an hour.

Barber County

Olson Oil Co. and others No. 1 Nuckolls, NE NE SW section 30-31-11w, Whelan area, Barber County,



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flowed 338 bbls. of oil in seven hours and on potential test flowed 163 bbls. of oil in four hours, making potential of 978 bbls. Chat was topped at 4,275 feet, total depth 4,295 feet.

Olson Oil Co. and others No. 2 Nuckolls, C N half N half SW section 30-31-11w, Whelan area, was building rotary rig. Davis No. 1 Nuckolls, SW SW NE section 30-31-11w, was a location.

Cowley County

Ralph Wixson and others No. 1 Clover, C SE SE section 8-31-7, Cowley County, was bottomed at 1,463 feet, perforated casing at 1,136-1,200 feet, and produced 5,000,000 feet of gas.

Sinclair Prairie Oil Co. No. 1 Turner, NE SE NW section 30-32-6, topped Mississippi lime at 3,005 feet and was dry and abandoned at 3,129 feet, total depth.

E. B. Shawver No. 3 fee, SW SE NE section 3-30-4e, was drilling below 1,220 feet.

Butler County

Rex & Morris No. 3 DeMoss A, SE NW NW section 8-28-7, Butler County, had Bartlesville sand at 2,652-83 feet, total depth, was shot and pumped 30 bbls. of oil daily.

Adair & Morton No. 1 Brandt B, NW NE NW SE section 15-28-7, was a machine. Allbe Oil Co. No. 22 Wilson, C S half N half NW NE section 27-25-5, was drilling below 400 feet. Deep Rock Oil Corp. No. 7 Hill, SW NW NW section 32-26-5, set 8-inch casing at 2,321 feet.

Greenwood County

Hutchinson Oil & Gas Co. No. 1-B Wygle, NE SE SW section 12-27-10, Greenwood County, topped Mississippi lime at 1,880 feet, total depth 1,902 feet, and plugged back to 1,900 feet. After acidizing, it pumped 35 bbls. of 31-gravity oil daily.

Anderson & Reed No. 2 Erickson, NE SW NW SE section 17-24-13, was a machine. Whittaker and others No. 1 Bresner, NW NW SE section 3-26-13, was a machine.

Stevens County

Panhandle Eastern Oil & Gas Co. No. 1 Newby, C NE section 27-31-37w, Hugoton area, Stevens County, was bottomed at 2,850 feet, plugged back to 2,650 feet, acidized and produced 3,500,000 feet of gas.

Kuhn Brothers No. 1 Carpenter, C NW section 20-33-36w, set 10-inch casing at 580 feet and was waiting on cement to set.

More New Activity

In Reno County, Campbell & Davis No. 2 Welch B, C NE SE section 4-24-4w, was drilling below 1,030 feet.

In Sumner County, Colonial Oil Co. No. 1 Miles, SE NE NE section 30-30-4w, wildcat, was moving in material. Stanolind Oil & Gas Co. and Amerada Petroleum Corp. No. 1 Frambers, SW SW NW section 34-31-1w, was building rotary rig.

In Woodson County, Sinclair Prairie Oil Co. No. 14 MacClaskey A, C W half E half W half SE SE section 30-23-14, was a location; Chris Sheedy No. 12 Klick, C W half SW SE section 20-25-14, was a machine; Aikman & Braden No. 2 Arnold, C W half E half W half NE section 35-23-14, was drilling below 1,140 feet.

Three wells pumped by one unit in the Haven field of Kansas. The third line is not shown here but balances the line of rods coming out between the two sides of the foundation

Oklahoma Fields

(Continued from Page 247)

In Hughes County, Dan Rines No. 1 Hawthorne, SW SW SE section 19-7-10, wildcat, was a location; Phillaine Oil Co. No. 1 Morrison, SE SE SW section 13-9-10, wildcat, was a location.

In Okfuskee County, Hayes and others No. 1 Kennedy, SW SW SE section 21-10-11, an old well deepened from 2,660 feet to 2,829 feet, was shut down for 6-inch casing; Sun Oil Co. No. 1 Krumme, SW SW NE section 32-12-10, an old gas well, bottomed at 3,190 feet, cemented off Cromwell and was drilling cement.

In Stephens County, Skelly Oil Co. No. 31 Selby, NW NW SW section 26-1s-5w, was a location in the Santa Fe pool.

Revised Figures on Iranian Petroleum Production Issued

Revised figures on Iranian crude oil production for 1936 show a total of 8,198,119 tons. Using the conversion factor of 7.55 bbls. per ton, the 1936 production was 61,895,798 bbls., instead of 62,565,000 bbls. The Bureau of Mines figure of 1935 showing Iran production of 57,304,000 bbls. is slightly higher than that furnished the trade press. Anglo-Iranian Oil Co., the only producer in Iran, reports the 1935 figure should be 7,487,697 tons or 56,532,112 bbls.

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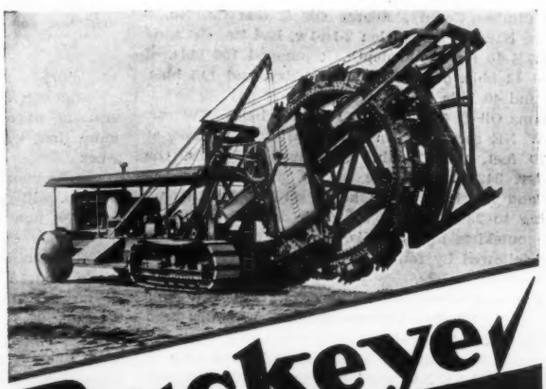

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Central West

By STAFF CORRESPONDENT

Add 9 Wells in Basin Area; Deepening Opens New Pay

MATTOON, Ill., Feb. 25.—Nine new oil wells and three dry holes constituted the record of field work in Central Basin fields in the past week. Two near completions in Richland County and two wells deepened in Clay County, with increased production resulting, are not included. The deepening of the wells in Clay County, with added production resulting, is a favorable indication of what may occur in other wells in the deep part of the basin.

Completions

One well in Clay County and another in Richland County were benefited by having been deepened to a new pay. Graham & Duncan No. 2 Land Bank, SE SE NE section 8-2n-8e, in the southeast extension of the Clay City field, had been pumping 20 bbls. a day from a total depth of 3,003 feet. It was deepened to 3,036 feet, penetrating a soft sand from 3,003 feet to the total depth. It swabbed 30 bbls. per hour for nine hours, and then was acidized, following which it was put on the pump and produced 168 bbls. of oil in 24 hours. In Richland County, Miller & Ake No. 1 Goede, SE cor. NW NE section 17-3n-9e, an old well at a total depth of 2,954 feet, with the original pay at 2,-944-49 feet, was deepened to a pay at 2,994-3,000 feet, total depth 3,003 feet. Both pays were acidized, the upper with 3,000 gallons, and the lower with 2,000 gallons. The well responded with a flow of 264 bbls. of net oil the first 24 hours.

In Clark County, M. V. Yeager abandoned No. 1 Robinson, SE SW NW section 17-10n-11w (measuring from the Indiana Principal meridian). Water was uncovered at 2,550-55 feet, total depth.

In Clinton County, Adams Oil & Gas Co. No. 3 Schmitz, NW NE SE section 2-1n-1w, had Benoist sand at 1,327½-48 feet, total depth. It pumped 109 bbls. of oil and 42 bbls. of water the first day, and 115 bbls. of oil and 40 bbls. of water the second day.

Adams Oil & Gas Co. No. 1 Hefter heirs, NW cor. NE SW NE section 13-1n-1w, found Benoist sand at 1,350-70 feet, total depth. It pumped 275 bbls. the first day, 342 bbls. on the second, 315 bbls. on the third, and 253 bbls. in 19 hours on the fourth day, dropping to 284 bbls. on the fifth day. This well is on the outskirts of Centralia, but in Clinton County. It was followed by four new locations in sections 12 and 13 on town lots.

Phelps and others No. 1 Gubser, C W half W half NW section 4-3n-2w, Clinton County, was dry and abandoned at 1,403 feet.

In Effingham County, S. Holles and others No. 1 Haarman, NW SE NW section 32-8n-6e, was dry and abandoned at 2,709 feet. It had McClosky top at 2,443 feet and St. Louis top at 2,455 feet, and had a showing of oil and gas at 2,665-69½ feet.

In Jasper County, C. R. Obermeyer was reported to have abandoned his test in C NW NE section 3-6n-9e, at 200 feet. No cause was given.

Pure Oil Co. completed the best well of the week in Richland County, No. 1 Hundley, C E half SE NE section 5-3n-9e. It found pay at 2,939-62 feet, bleeding dolomitic limestone, and saturated dolomite at 2,980 to 3,004 feet, total depth 3,015 feet. The well flowed 1,630 bbls. the first day, 1,765 bbls. the second day and 1,760 bbls. the third day, with casing pressure 550 pounds. The well produced through 2½-inch tubing run to 2,936 feet, with the last 3 inches perforated. Six-inch casing had been set at 2,962 feet.

The Ohio Oil Co. No. 9 Arbuthnot, C W half SW NE section 8-3n-9e, flowed 331 bbls. in 24 hours through seven-eighths inch choke on 2½-inch tubing. Pay was found at intervals at 2,946-65 feet.

Johnson & Doran No. 1 Bristow, SW cor. NW NW SE section 17-3n-9e, had pay at 2,950-56½ feet, total depth 2,975 feet. It was acidized with 4,000 gallons and later flowed 505 bbls. in 24 hours through casing.

Pure Oil Co. No. 1 Brant, 180 feet from north and 1,445 feet from east lines of SE quarter section 17-3n-9e, swabbed and flowed 169 bbls. per day from pay at 2,955-78 feet.

Max Pray and others No. 1 Runyon, SW SW SE section 21-3n-9e, was acidized with 2,000 gallons and then with 3,000 gallons, and later produced 139 bbls. in 24 hours. It topped Roseclaire at 3,009 feet and cored saturation at 3,111-21 feet, total depth.

Mammoth Producing & Refining Co. No. 1 Bell, NW NE SW section 28-3n-9e, mentioned last week as having flowed 2,412 bbls. on a 30-hour test, producing from pay at 3,057-63 feet (corrected), was flowing 67½ bbls. an hour, or at the rate of 1,620 bbls. per day, five days later. It was completed. Same company did not do so well with its No. 5 Stanford Heitz, SW NW NW section 34-4n-9e, which was a 13-bbl. well after a 1,500-gallon acid treatment at a total depth of 3,034 feet.

Bur-Kan Oil Co. No. 1 Allen, C SW NW section 27-4n-10e, had McClosky top at 3,038 feet, total depth 3,045 feet. It flowed 1,800 bbls. by heads, then died down. After a wait of several days it was acidized with 5,000 gallons and flowed 660 bbls. in 24 hours, and followed this with 2,385 bbls. in nine days, or at an average of 265 bbls. per day. It was then put on the pump and made 70 bbls. in 14 hours; then 156 bbls. and 193 bbls. on successive 24-hour tests. It was completed.

In Wayne County, Gordon and others abandoned the location for No. 1 Taylor, NW SW SW section 5-1n-7e.

Pure Oil Co. will not drill its No. 2 Clay, C W half NE NW section 27-1n-7e, but will make a diamond drill test for geological purposes on the location.

18 New Starts

Eighteen first reports of new and prospective operations were garnered during the past week, which more than kept pace with the completed work of the week.

In Richland County, Mammoth Producing & Refining Co. will deepen No. 1 Brace, SW SE NW section 28-3n-9e, now at a total depth of 3,046 feet.

In Clay County, Pure Oil Co. has derrick up for No. 2 McKinney, C E half SW SW section 9-2n-8e.

In Clinton County, Santa Fe Oil Co. was moving in material for No. 2 Maddok, SW cor. NW section 4-1n-3w. Shell Petroleum Corp. made a location for No. 1 Buchler, 92 feet from north and 1,100 feet from west lines of section 12-1n-1w, in the Centralia area. Adams Oil & Gas Co. was moving in rotary to start No. 1 Felton, C NW SW NW section 1-1n-1w. Adams Oil & Gas Co. had rig up for No. 1 Marshall, 215 feet from east and 990 feet from south lines of SW quarter section 12-1n-1w. Connery and others were drilling at 200 feet in No. 1 Feldman, 910 feet from south and 629 feet from east lines of SW quarter section 12-1n-1w. Rourk & Moore had rig up for No. 1 Ida Quick, SW cor. NW SE NE section 13-1n-1w. John Pugh Drilling Co. made location for No. 1 Copple, NW cor. SW NE NE section 13-1n-1w. A. B. Ryan had rig up for No. 1 Bent, NW cor. SW NE NE section 13-1n-1w, and I. T. Evans & Co. had rig up for No. 1 Huff, NW cor. NW SE NE section 13-1n-1w. All but one of these locations are in the suburbs of Centralia.

In Richland County, locations were made for Bur-Kan Oil Co. No. 2 Allen, C W half SE NW section 27-4n-10e, and Ohio Oil Co. No. 10 Arbuthnot, C E half SE NW section 8-3n-9e. B. C. Morrison had derrick up for No. 1 Conour, 100 feet from north and 660 feet from west lines of NW quarter section 34-4n-10e, and Pure Oil Co. had derrick up for No. 1 McFarlin and others, 330 feet from south and 170 feet from east lines of NE SW section 17-3n-9e. Pure Oil Co. was drilling at 725 feet in No. 1 Taylor, C E half NE SW section 8-3n-9e.

In Washington County, Frost & Vickers were running 6-inch casing to 926 feet in No. 1 Franks, SW NW NW section 28-1s-4w.

Among the Drilling Wells

In Bond County, McBride, Inc., No. 1 Butler, SW SW SE section 30-4n-2w, was shut down while repairs were being made.

In Clay County, Pure Oil Co. No. 1 Mitchell, C N half SE SE section 5-2n-8e, had Ste. Genevieve lime top at 2,929 feet, and was coring at 2,999 feet, with no showings reported. Pure Oil Co. No. 3 Brissenden, SE NW NE section 8-2n-8e, had showings of oil at 2,642-49 feet and 2,666-72 feet, and was drilling at 2,964 feet. Southern Illinois Petroleum Co. has had very little oil showing thus far in No. 1 Nodacker, NW SE NW section 23-3n-7e. A core was being pulled at 3,110-35 feet. Vermilion Oil Co. No. 1 Smith estate, NE cor. NW SW NW section 20-3n-8e, had Roseclaire top at 2,996 feet and the crew was coring at 3,010 feet. Pure Oil Co. No. 2 B. Travis-B, CWL NW NW NW section 33-3n-8e, had Weiler sand top at 2,633 feet and was drilling at 2,715 feet.

In Clinton County, Shell Petroleum Corp. and Adams Oil & Gas Co. No. 1 Criley-Felton, SW SW NW section 1-1n-1w, found sand at 1,340-65 feet, total depth 1,370 feet. Seven-inch casing was set at 1,336 feet and the crew was drilling plug. Shell Petroleum Corp. No. 1 Koelmel, SE SW SW section 1-1n-1w, was drilling in sand at 864 feet. Shell Petroleum Corp. No. 1 Pitchford, NE NW SW section 1-1n-1w, had Benoist sand at 1,332-60 feet, total depth 1,365 feet, in shale, and a machine was being moved in to finish the well. Adams Oil & Gas Co. No. 4 Schmitz, NE NE SE section 2-1n-1w, had Benoist sand at 1,326-47 feet, total depth 1,351 feet, in shale, and a machine was being moved in to complete. Lilly and others were drilling at 780 feet in No. 1 Siegler, NW cor. NE NE SE section 12-1n-1w. Connery and others No. 1 Barth, SW cor. NW SE SW section 12-1n-1w, had sand at 1,375-93 feet. It was shot with 10 quarts and the hole filled 550 feet with oil and 500 feet with salt water. It will be given a pumping test.

In Edwards County, Leach Brothers No. 1 Lee, SW NE SW section 11-1s-10e, was drilling at 3,080 feet in shale.

In Fayette County, Carter Oil Co. No. 1 Dove, C E half NW SE section 15-8n-3e, had Benoist sand at 1,480-94 feet. The crew bailed 20 bbls. of oil and 5 bbls. of salt water in 24 hours. Then the hole caved in. The cave was cemented off and the crew was waiting for cement to set.

In Jackson County, Stanolind Oil & Gas Co. No. 1 Leiner, NE NW SW section 20-7s-4w, was drilling at 3,350 feet. Trenton rock was topped at 3,293 feet.

In Jefferson County, Carter Oil Co. No. 1 Doughitt, C E half NE SE section 9-1s-2e, has Bethel sand at 1,947-62 feet, total depth. Six-inch casing was set at 1,941 feet. Sturboist & Tomberlin No. 1 Morse, NW cor. SW section 6-2s-2e, topped Bethel sand at 2,067 feet and cored to 2,081 feet. Six feet of core was recovered, with a small showing of oil. The core was salty at the base. Drilling was continued.

In Marion County, W. C. McBride, Inc., was drilling at 1,895 feet in No. 1 Clow, SW SW SE section 29-2n-1e.

Near Completions

In Richland County, Pure Oil Co. No. 1 Montgomery, C E half SE NW section 4-3n-9e, was at a total depth of 3,000 feet, having topped Ste. Genevieve limestone at 2,899 feet, and Roseclaire formation at 2,917 feet. It found dolomitic pay at 2,967-78 feet and

(Continued on Page 264)

California Field Report

By
L. P. STOCKMAN

New Deep Well at Kettleman Hills Is Not a Large Producer

LOS ANGELES, Calif., Feb. 21.—Superior Oil Co. has confirmed the discovery of Kettleman North Dome Association (Kenda), in the Kettleman North dome field proving the Avenal zone of Eocene age commercially productive, and it is possible that several additional wells will be carried down to the new horizon in the near future by Superior Oil Co., Union Oil Co., Standard Oil Co. and Kanada. No rush to exploit the new zone is anticipated as the initial daily production of Superior's new deep well was below expectations. Standard Oil Co. and Kenda each started a deep test in this field a few months ago and Standard No. 27-21-J, in section 21-21-17, has already passed the 10,000-foot level. Kenda's deep well, No. 67-20-J, in section 20-21-17, is just below 9,300 feet. Superior Oil Co.'s new deep Eocene producer is No. 5 Huffman in section 29-21-17. It was redrilled and deepened from the Temblor to the Eocene, and completed flowing 625 bbls. of exceptionally clean 47.1-gravity oil and 3,000,000 feet of gas per day through a 1-inch bean. It was finished with 692 feet of 4¾-inch aluminum liner, including 415 feet of perforated, landed at 10,734 feet, and cemented through perforations at 10,319 feet.

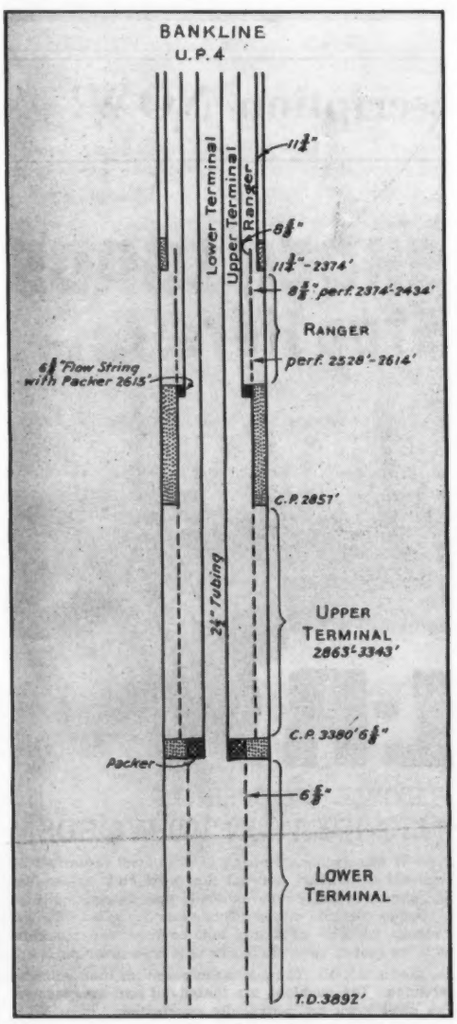
Kenda's deep test No. 4-18-J in section 18-21-17 came in "wet" a few days ago and is flowing 1,383 bbls. of oil and 1,305 bbls. of water along with 1,770,000 feet of gas per day. This well, in the extreme western end of the Kettleman structure, was plugged back to 10,810 feet from 11,746 feet where mechanical trouble developed. Production is coming from the bottom of the hole, and unless the output cleans up in the near future the association may plug back to a point where a test made in 1937 indicated larger and cleaner production.

Standard Oil Co. completed a well in the Temblor in the past week. No. 76-1-P was finished flowing 1,610 bbls. of clean 33.6-gravity oil and 740,000 feet of gas per day from 8,474 feet. It was finished with 504 feet of 5¾-inch liner including 244 feet of perforated landed at 8,469 feet and cemented through perforations at 8,225 feet. Standard Oil Co. has also concluded drilling No. 2-11-P in section 11-22-17, and it should be tanking oil within a few days. In the Wasco district of Kern County, Continental Oil Co. has reached a depth of 13,460 feet in No. 2-A Kern County Land in section 8-27-24, and while the present formation is believed to be the Rio Bravo sand, it has practically no porosity or permeability. The well was still going ahead.

Wilmington

Seven new wells were completed in the Wilmington field of Los Angeles Basin in the past week and two of them resulted in substantial production. No. 4 Union Pacific of Bankline Oil Co. flowed 7,000 bbls. initially from three zones simultaneously and No. 1 Cedarholm Community flowed 4,330 bbls. from the Upper and Lower Terminal zones. In order to produce the Ranger, Upper Terminal, and Lower Terminal zones simultaneously and thus increase the productive capacity of the well a new casing program designed to permit uninterrupted sustained production and at the same time eliminate the commingling of production from one or more zones was adopted. The practice began several months ago when operators started producing the Ranger and Upper Terminal zones simultaneously, but this did not prove entirely satisfactory as it was believed possible that the Ranger zone, due to its lower pressure was somewhat of a thief zone and thus prevented the development of maximum production from the Terminal zone. Operators then began changing the hookup and under this plan produced the Ranger zone in the annular space between the tubing and casing and the Upper Terminal zone through the tubing after packing off the tubing below the Ranger zone.

The latest modification in the casing program permits the simultaneous production of the Ranger, Upper Terminal and Lower Terminal zones by the use of a 6⅝-inch flow string, an 8⅝-inch liner, 11¾-inch casing, a string of 2½-inch tubing, a pack-off around the tubing, and two cement jobs through perforations. Completion data on Bankline Oil Co. No. 4 Union Pacific will indicate the latest casing program for a multiple zone producer. After landing 273 feet of 18⅝-inch surface pipe the company drilled ahead to 2,390 feet and cemented a string of 11¾-inch at 2,374 feet. The well was then drilled ahead to the completion depth, 3,892 feet, and 1,011 feet of 8⅝-inch liner carrying 80-mesh perforations at 2,374-2,434 feet, 2,528-2,614 feet and at 2,863-3,343 feet, was landed at 3,343 feet and cemented through perforations at 2,857 feet. A total of 544 feet of 6⅝-inch liner carrying 504 feet of 80-mesh was then landed at 3,388 feet and cemented through perforations at 3,380 feet. A 6⅝-inch flow string with packer was then run in and landed at 2,615 feet, followed by 3,390 feet of 2½-inch tubing with a packer at 3,345 feet. Under this program Bankline Oil Co. No. 4 Union Pacific is producing Ranger zone production between a 6⅝-inch and 8⅝-inch, Upper Terminal zone production between the tubing and 8⅝-inch, and the Lower Terminal zone production through the tubing.



The latest method of completing multiple-zone producers in the Wilmington field of Los Angeles Basin. This casing record was used by Bankline Oil Co. on No. 4 Union Pacific, which is flowing from the Ranger, Upper Terminal and Lower Terminal zones simultaneously, without mixing the oil

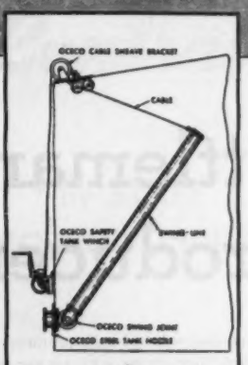
Additional Completions

Long Beach Harbor Oil Co. No. 1 Cedarholm Community was completed flowing 4,330 bbls. from the Upper and Lower Terminal zones after blanking off the Ranger zone. It is flowing 2,150 bbls. of clean 23.4-gravity oil daily through the casing from the Upper Terminal zone and 2,180 bbls. of clean 23.8-gravity oil daily through the tubing from the Lower Terminal zone. The well is bottomed at 3,805 feet, and finished with 11¾-inch casing landed and cemented at 2,450 feet and 1,395 feet of 8⅝-inch liner landed at 3,796 feet. The liner carried 50-mesh perforations at 2,850-3,385 feet and at 3,365-3,796 feet and was cemented through perforations at 2,850 feet and 3,365 feet. A string of 3-inch tubing was run in to 3,600 feet and a packer placed at 3,342 feet. Superior Oil Co. completed two wells on the Back Bay property in the Long Beach section of the Wilmington field. No. 1 Back Bay flowed 445 bbls. of clean 16.5-gravity oil daily through a 22/64-inch bean, while No. 14 Back Bay flowed 215 bbls. of clean 16.7-gravity oil daily through a 60/64-inch bean from 3,018 feet. The former was finished with 410 feet of 8⅝-inch liner including 372 feet of perforated landed at 2,940 feet and 2,778 feet of 2½-inch tubing with a packer at 2,550 feet.

General Petroleum Corp., discoverer of the Wilmington field, is expected to complete six new wells within the next 10 days and of them two are on the Ford lease and three on the Harbor Community lease. During the past week the company completed No. 2 Harbor Community in the upper zone, flowing 422 bbls. of 17.1-gravity oil daily from 2,993 feet. The company's previous completion on the Harbor Community lease was No. 6 which is flowing 5,570 bbls. of clean 25.5-gravity oil daily from 3,890 feet. Richfield Oil Corp. No. 2 Star Drilling has been completed pumping 148 bbls. of 14.7-gravity oil daily from the Ranger zone at 3,334 feet. Union Pacific Railroad Co., largest holder of undeveloped acreage in the Wilmington field, and with four new wells nearing completion, finished No. 46 flowing 1,170 bbls. of clean 23.6-gravity oil daily from 2,860 feet. The Westgate-Greenland Oil Co. resumed drilling on Nos. 1, 2, 3, and 4 on the Long Beach Harbor Department lease. State officials who have claimed title to Los Angeles and Long Beach tide lands have filed a series of suits petitioning the court for an accounting of all oil and gas produced and a decision respecting titles to the tide lands in question.

Involved Litigation

The situation regarding tide lands in southern California has been further complicated by a recent ruling of the California Supreme Court that the Olson bill could not legally be considered an urgency measure, and was therefore subject to referendum to the electorate. This means the state has no existing tide land development measure and therefore can not issue any drilling permits in either the Long Beach, Huntington Beach or Wilmington areas. It is the intention of legislators to cancel the Olson bill at the projected special session of the legislature as soon after March 1 as possible and eliminate the urgency clause. Adoption of a similar bill without an urgency clause will make the measure effective 90 days after signature of Governor



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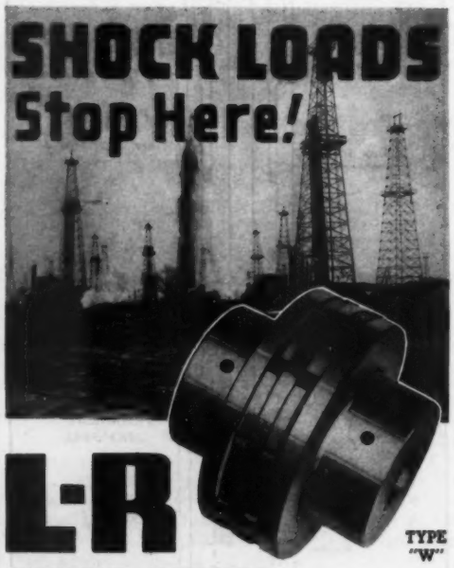

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Merriam. The Los Angeles City Council has voted to lift present drilling restrictions in the area west of Avalon Boulevard in the original section of the Wilmington field and drilling operations will soon be under way in the district bounded by Opp Street, Marine Avenue, O Street and a line 170 feet west of the west line of Avalon Boulevard. The new area opened up for development is north of Anaheim Street and consists of a few square blocks, it being the present intention to extend the area for development gradually. Existence of several substantial buildings along Avalon Boulevard and Anaheim Street has prevented the lifting of drilling restrictions south of Opp Street but it is not improbable that drilling restrictions may ultimately be lifted south of Anaheim Street and west of Avalon Boulevard if development work justifies the expense.

Santa Maria Valley

The Hancock-Bush interests completed an excellent well in the Santa Maria Valley field when No. 2 Rosenbloom in section 25-10-34 was brought in flowing 4,800 bbls. per day from 4,435 feet. This new well was subsequently shut in because of curtailment but just before being taken off production the well was flowing better than 7,000 bbls. per day, the oil being clean and testing 16.3 degrees in gravity. This well was completed with a 6⅝-inch liner and that it had plenty of kick is evidenced by the fact that it only required six runs of the swab to bring the well in. Union Oil Co. completed two new wells during the week but both were only relatively small producers. The latest completion was Union No. 1 Wheat in section 22-10-34 an offset to No. 1 Acquistapace a producing well near the Pacific Coast Railroad tracks in the west side area of the Santa Maria Valley field and it was finished pumping 441 bbls. of clean 16.2-gravity oil per day. This new well was bottomed at 4,181 feet and finished with an 8⅝-inch water string landed and cemented at 3,840 feet and 365 feet of 6⅝-inch liner including 340 feet of 180-mesh landed at 4,180 feet. No. 3 Moretti in section 24-10-34 proved good for 242 bbls. of 16.4-gravity oil per day on the beam from 2,805 feet. There is a growing dissatisfaction prevalent among producers in the Santa Maria Valley field because of the alleged low quota set up for the field. Since the first of 1938 Union Oil Co., which has the only pipe line out of the area, has been taking 10,000 bbls. per day rateably from all producers in the area. Due to the large amount of sulfur in the crude, despite the relatively high amount of gasoline per barrel of crude, there is only a limited market for production. As a consequence Union has been storing its excess and therefore does not deem it advisable to increase the allowable. The 10,000 bbls. per day allotted to producers is split up into an allowable of 5,000 bbls. per day for producing wells and 5,000 bbls. per day for acreage. At present this means a production allowable of 130 bbls. per well per day and an additional 1 bbl. for each acre and thus if the well is located on a 5-acre lease the permitted production would be 135 bbls. per day. E. H. Moore, Inc., is completing No. 13-E in section 24-10-35 at 5,527 feet and should have this well on steady production within another week.

Gas Fields

Amerada Petroleum Corp. finished a new gas well in the Rio Vista gas field of Solano County when No. 1 McCormick in section 1-3-2 was brought in flowing 35,000,000 feet per day from 4,385 feet after a 7-inch water string had been landed at 4,001 feet and the hole finished with a 5-inch liner. Top of the productive dry gas zone was topped at 4,055 feet indicating that Amerada has a penetration of about 330 feet into the zone.

In the Potrero Hills structure of Solano County, Richfield Oil Corp. has made tentative location for a test in section 10-4-1 and spud is expected to be made within three weeks. Ohio Oil Co. will probably begin making hole in its second wildcat in the Willows area of Glenn County within another few days as No. 1-A Willard in section 18-20-2 is just about completely rigged up. Ohio's initial wildcat in the Willows area blew out a month or two ago and was destroyed when the derrick and equipment fell into a wide crater. Gas flowed up through the crater for several weeks before the well sanded up. On the showing of No. 1 Willard it is probable that Ohio Oil Co. has discovered a new dry gas field of substantial proportions in the Willows area. In the McDonald Island gas field of San Joaquin County, Standard Oil Co. has reached a depth of 8,140 feet in No. 2 Weyl Zuckerman in section 25-2-4 and the bit is going ahead in brown shale at present.

STANDARD OIL CO. OF CALIFORNIA AND UNION OIL CO

Crude oil prices at the well effective June 22, 1936

Gravity—	Signal Hill (Long Beach)	Seal Beach	Alamitos Heights	Huntington Beach	Inglewood	Playa del Rey	Olinda-Brea Canyon	Athens-Rosecrans	Dominguez	Elwood Terrace	Torrance	Richfield	Whittier E. Coyote (La Habra)	Montebello	W. Coyote Hills	Santa Fe Springs	Mountain View	Elk Hills Buena Vista Hills Midway-Sunset Lakeview Area	Lost Hills	Coalinga	Wheeler Ridge	Kettleman Hills	Santa Paula*	Orcutt*
14-14.9	$.80	$.79	$.74	$.78	$.79	$.80	$.76	...	...	...	$.80	$.76	$.76	$.77	$.78	...	...	$.70	$.70	$.70	...	...	$.70	...
15-15.9	.80	.79	.74	.78	.79	.80	.76	...	...	...	.80	.76	.76	.77	.78	...	...	.70	.70	.70	...	...	.70	...
16-16.9	.80	.79	.74	.78	.79	.80	.76	...	...	...	.80	.76	.76	.77	.78	...	...	.70	.70	.70	...	...	.70	$.70
17-17.9	.80	.79	.74	.78	.81	.80	.76	...	...	...	.80	.76	.76	.77	.78	...	...	.70	.70	.70	...	...	.71	.70
18-18.9	.80	.79	.74	.78	.84	.80	.78	...	...	...	.82	.76	.76	.77	.78	...	...	.70	.70	.70	...	...	.73	.72
19-19.9	.82	.79	.74	.82	.87	.84	.81	...	...	...	.85	.76	.78	.77	.78	...	$.70	.74	.74	.71	$.70	...	.75	.74
20-20.9	.85	.79	.74	.85	.90	.88	.84	...	...	...	.88	.78	.82	.77	.80	...	.70	.78	.78	.72	.70	...	.77	.77
21-21.9	.88	.79	.74	.89	.93	.93	.88	...	...	...	.91	.80	.85	.77	.84	$.78	.73	.82	.82	.74	.70	...	.79	.80
22-22.9	.92	.82	.74	.92	.96	.98	.92	...	...	...	.93	.84	.89	.79	.88	.78	.77	.87	.86	.78	.72	...	.82	.83
23-23.9	.95	.86	.77	.96	.99	1.02	.96	$.84	$.79	...	.96	.88	.93	.82	.92	.78	.80	.92	.90	.82	.76	...	.85	.86
24-24.9	.99	.91	.80	1.00	1.02	1.06	.99	.88	.81	...	.99	.91	.96	.85	.96	.82	.84	.97	.94	.86	.79	...	.87	.88
25-25.9	1.03	.95	.82	1.03	1.05	1.11	1.03	.93	.83	...	1.02	.95	...	.89	.99	.86	.88	1.01	.98	.90	.83	...	.90	.91
26-26.9	1.06	1.00	.85	1.07	1.09	1.16	1.06	.98	.86	...	1.05	.98	...	.92	1.03	.90	.91	1.06	1.02	...	...	...	.92	.93
27-27.9	1.10	1.05	.88	1.11	1.12	...	1.10	1.03	.88	...	...	1.02	...	.96	1.06	.95	.95	1.10	1.06	...	...	...	.95	...
28-28.9	1.14	1.10	.90	1.14	1.15	...	1.14	1.07	.90	...	...	1.06	...	.99	1.10	.99	.99	1.15	1.10	...	...	...	.97	...
29-29.9	1.17	1.15	.93	1.18	1.18	F.O.B.	1.17	1.12	.93	...	...	1.09	...	1.03	1.14	1.03	1.02	1.20	1.14	...	...	...	.99	...
30-30.9	1.21	1.19	.95	1.22	1.21	our	1.21	1.17	.95	F.O.B.	...	...	...	1.07	1.17	1.08	1.06	1.25	1.18	...	...	...	1.01	...
31-31.9	...	...	...	...	1.24	Pipe	1.24	1.22	.97	Ship	...	...	...	1.11	1.21	1.12	1.09	1.29	...	...	...	...	...	...
32-32.9	...	...	...	...	1.27	Line	1.27	1.27	1.00	...	...	...	...	1.14	1.25	1.16	1.13	1.34	...	...	...	...	...	...
33-33.9	...	...	...	...	...	...	...	1.32	...	$1.28	...	...	...	1.18	1.28	1.20	1.17	1.38	...	...	...	$1.19	...	...
34-34.9	...	...	...	...	...	...	...	1.37	...	1.32	...	...	...	1.22	1.32	1.25	1.20	...	...	...	...	1.23	...	...
35-35.9	...	...	...	...	...	...	...	1.42	...	1.35	...	...	...	1.25	...	1.29	...	...	...	...	...	1.27	...	...
36-36.9	...	...	...	...	...	...	...	1.46	...	1.39	...	...	...	1.29	...	1.33	...	...	...	...	...	1.31	...	...
37-37.9	...	...	...	...	...	...	...	1.51	...	1.43	...	...	...	1.32	...	1.37	...	...	...	...	...	1.35	...	...
38-38.9	...	...	...	...	...	...	...	1.56	...	...	...	...	...	1.36	...	1.42	...	...	...	...	...	1.39	...	...
39-39.9	...	...	...	...	...	...	...	1.61	...	...	...	...	...	1.40	...	...	...	...	...	...	...	1.43	...	...
40-40.9	...	...	...	...	...	...	...	1.66	...	...	...	...	...	1.43	...	...	...	...	...	...	...	...	...	...

Newhall, McKittrick, Kern River, Kern Front and Round Mountain, 70 cents for all grades. *Posted by Union Oil Co. Same company's Brea Canyon schedule stops at $1.14 for 28 degrees and over, and Belridge and Lost Hills schedule stops at $1.32 for 37 degrees and over. By Standard Oil Co., effective October 15: El Segundo, 14 to 18.9 degrees, 80 cents; 19-19.9, 82 cents; 20-20.9, 85 cents; 21-21.9, 88 cents; 22-22.9, 92 cents; 23-23.9, 95 cents; 24-24.9, 99 cents; 25-25.9, $1.03; 26-26.9, $1.06; 27-27.9, $1.10; 28-28.9, $1.14; 29-29.9, $1.17; 30-30.9, $1.21. Wilmington, 14 to 16.9, 75 cents; 17-17.9, 77 cents; 18-18.9, 79 cents; from 19 degrees upward, prices same as Signal Hill.

San Joaquin Basin

Shell Oil Co. extended the Ten Section field one location west by completing No. 85-25-B Kern County Land in section 25-30-26 flowing 2,172 bbls. of clean 32.8-gravity oil and 1,680,000 feet of gas per day from 8,220 feet. This new well was finished with 202 feet of 4¾-inch liner including 178 feet of perforated, landed at 8,218 feet. It is flowing through open line and shows pressures of 90 pounds on the tubing and 1,680 pounds on the casing. No. 52-B Kern County Land in section 31-30-26 should be Shell's next producer in this field as it is in the pay at 8,221 feet and will probably not be carried much deeper.

In the Mount Poso field, Ring Oil Co. completed No. 2 Roger Jones in section 29-26-28, pumping 338 bbls. of clean 16.9-gravity oil per day from 1,753 feet, and is making preparations to spud in No. 6 Bowles in the same section.

In the Round Mountain field of Kern County, Vedder Petroleum Co. completed No. 1 Bell pumping 340 bbls. of clean 17.6-gravity oil daily from 1,745 feet after finishing the hole with 82 feet of 6⅝-inch liner including 37 feet of 100 mesh landed on bottom and Shell Oil Co. recompleted No. 18 Caldwell pumping 175 bbls. of 17.8-gravity oil daily from 1,954 feet after plugging back the hole from 1,970 feet.

Los Angeles Basin

In the Torrance field where operators are developing a new zone encountered around the 5,000-foot level which appears to be good for wells averaging around 200 bbls. per day, three deepened wells were put on

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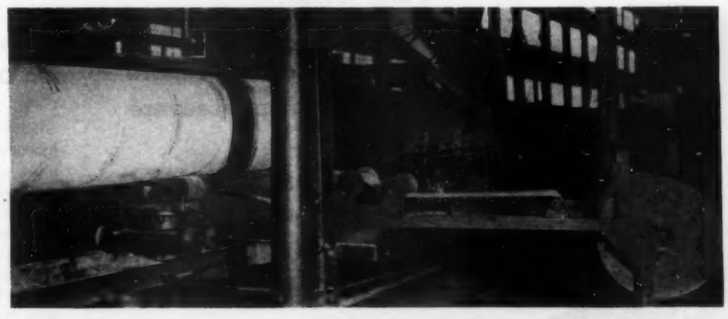

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TANKER SHIPMENTS FROM LOS ANGELES TO DOMESTIC AND FOREIGN PORTS

	February 11		February 4			
	Total this week	Daily average	Total last week	Daily average	This year to date	Same time last year
Intercoastal-domestic:						
Diesel and gas oil	.....	.....	.....	.....	.....	176,726
Gasoline	80,512	11,502	.....	.....	344,116	79,106
Kerosene	.....	.....	.....	.....	59,885	.....
Foreign exports:						
Crude oil	67,093	9,585	578,075	82,582	2,180,626	752,847
Fuel oil	138,741	19,820	143,967	20,567	558,581	1,501,628
Diesel and gas oil	105,552	15,079	41,789	5,970	432,985	1,022,362
Gasoline	370,094	52,871	20,906	2,987	793,572	596,229
Kerosene	25,749	3,678	.....	.....	147,775	459,317
Coastwise-domestic:						
Crude oil	195,009	27,858	149,432	21,347	1,003,202	793,489
Fuel oil	221,582	31,655	212,596	30,371	1,677,742	1,661,667
Diesel and gas oil	37,322	5,332	8,449	1,207	200,425	75,859
Gasoline	171,591	24,513	284,977	40,711	1,692,858	1,433,996
Kerosene	1,781	254	8,996	1,285	28,854	8,034

TANKER SHIPMENTS FROM SAN FRANCISCO TO DOMESTIC AND FOREIGN PORTS

Intercoastal-domestic:						
Diesel and gas oil	.....	.....	.....	.....	178,662	75,895
Foreign exports:						
Crude oil	.....	.....	.....	.....	336,209	388,489
Fuel oil	26,654	3,808	.....	.....	52,685	188,107
Diesel and gas oil	20,027	2,861	.....	.....	118,920	322,233
Gasoline	166,929	23,847	.....	.....	305,402	765,563
Kerosene	15,172	2,167	.....	.....	85,841	115,972
Lubricants	.....	.....	.....	.....	.....	106,280
Coastwise-domestic:						
Fuel oil	91,411	13,059	112,606	16,087	823,707	813,159
Diesel and gas oil	18,953	2,708	32,588	4,655	212,621	58,124
Gasoline	102,606	14,658	96,722	13,817	880,453	537,236
Kerosene	14,315	2,045	20,511	2,930	113,991	3,367

production, but none of them came up to expectations. Torrance Petroleum Co., which recently took over the Grubb interests, has succeeded in recompleting No. 1 Grubb, pumping 126 bbls. of 22.8-gravity oil daily from 4,996 feet and Albertson Oil Co. recompleted No. 1 Peyton pumping 130 bbls. of 23.1-gravity oil daily from 5,120 feet. C. B. Patton finished work on No. 2 in this field at 5,017 feet and returned the well to production pumping 128 bbls. of 23.4-gravity oil daily.

In the Inglewood field Standard Oil Co. completed No. 84 Los Angeles Investment pumping 267 bbls. of oil and 121 bbls. of water per day from 3,615 feet after the hole had been carried down to 4,175 feet and then plugged back and finished with 314 feet of 4¾-inch liner landed at 3,610 feet.

El Segundo

In El Segundo field the Texas Co. wound up its development program by completing No. 6 Security, pumping 101 bbls. of 22.6-gravity oil per day from 7,315 feet. The output is cutting about 20 per cent.

Shell Oil Co. completed a small well in the Dominguez field when No. 93 Reyes was finished on a compressor doing 322 bbls. of 31.1-gravity oil per day from 6,850 feet after the hole had been plugged back from 7,106 feet.

As Rosecrans, Union Oil Co. only got a production of 35 bbls. per day from 4,970 feet after plugging back No. 35 Howard Park from 10,397 feet. This well was carried down in search of a deep zone but failed to encounter anything resembling production below the O'Dea deep zone.

Beth Petroleum Co. centered the attention of operators on the Yorba Linda district of Los Angeles Basin by coring 110 feet of very good looking oil sand in No. 1 Pickering, and the outlook is promising for a good well. Top of the pay was logged at 2,180 feet and drilling operations were concluded at 2,290 feet. Previous completions in this area have for the most part resulted in initials averaging around 150 bbls. per day. There is a possibility that Beth Petroleum Co. has found the same zone found by Shell Oil Co. on the Olinda Land property, which resulted in one well flowing at the rate of 1,500 bbls. per day. The Yorba Linda area is located east of East Coyote and southeast of the Brea Olindo fields.

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The better service insured by W-S Fittings is expressed in dollars saved in maintenance.

Write for Bulletin A-3.

THE WATSON-STILLMAN CO.
ROSELLE, N. J.

Louisiana-Arkansas Fields

(Continued from Page 234)

about 7 miles southeast of the Kerr-Lynn wildcat, where the Standard Oil Co. of Louisiana is beginning No. 1 Phillips, in section 15-17-19.

To the northwest, is Columbia and Lafayette counties, the Buckner field is also a center of interest. There, the Standard Oil Co. of Louisiana is drilling two tests, and Taubel and others are drilling one, in northeast, southeast and southwest outpost locations with reference to the Standard No. 1 McKean, sole producer in the field. All three tests are approaching critical depths, and Buckner is due for important developments shortly.

North, in Hempstead County, Easton and others are planning to deepen No. 1 Grone, section 5-12-26, to the Permian lime. The test has been shut down for several months at total depth of 2,940 feet.

Shuler Operations

The Shuler field in Union County, Arkansas, most active drilling center at the present time, gained two new producers during the week. The Alice Sydney Oil Co. No. 3 Morgan, NW NE SE section 18-18-17, made an initial production of 1,248 bbls. per day through a 24/64-inch choke. Tubing pressure and casing pressure were 400 pounds. Total depth is 7,717 feet.

The prolific Jones sand, which is the object of nearly all current drilling in Shuler showed large amounts of gas for the first time this week upon, completion of Phillips Petroleum Co. No. 2 Justiss. The test, on the northwest edge of present production, is one of the highest wells in the field. Its location nearest the top of the structure, caused it to be the first completed well to show the presence of a large gas cap, heretofore believed absent in the sand. The test, bottomed at 7,700 feet, originally perforated 7-inch casing at 7,528-52 feet, making 94 bbls. of oil on a three-fourths inch choke during the first hour's gauge, and 16 bbls. in the second hour on a reduced five-eighths inch choke. The second gauge showed tubing pressure of 800 pounds and casing pressure of 400 pounds, and much gas. Operators killed the well, and reperforated at 7,542-61 feet, and brought it in for an initial production of 971 bbls. per day on a 26/64-inch choke and tubing pressure of 1,200 pounds, and casing pressure of 1,500 pounds. It is making an estimated 2,000,000 feet of gas.

In Shuler the Marine Oil Co. No. 4 Justiss, in the center of Lot 7, NW section 18-18-17, is to be drilled deeper than the producing horizons. The test is now coring below 7,620 feet, projected for the Big lime, and will be watched with considerable interest by operators of the area.

Sweden's Special Committee On Oil Supply Makes Report

Recommendations have been made by a special committee appointed to investigate conditions of Sweden's petroleum supply that all importers of gasoline and motor fuel oils (diesel fuel) be required to maintain stocks on hand at all times corresponding to at least 30 per cent of the consumption during the previous year.

At the current rate of consumption this requirement will involve the maintenance of stocks estimated to total 400,000 cubic meters, crude and refined products included. Promulgation of the recommendations into law will necessitate doubling the present storage capacity.

The committee has also recommended that all new storage facilities be of bombproof construction which will require excavation and blasting, a part of the expense expected to be carried by the government. It is also recommended that domestic refineries should be expanded and that distributors in Sweden be required to handle specified portions of material refined within the country.

Michigan Field Report

By
O. C. PRESSPRICH

Five New Wells in Buckeye; Deep Mud Covers All Fields

SAGINAW, Mich., Feb. 21.—Handicaped by a siege of unseasonable spring-like weather, followed by a freeze and more soft weather, Michigan's oil fields were transformed last week into quagmires, and this for the next few weeks will be one of their greatest retarding agents. Back locations off main roads—and there are many—are almost inaccessible. Road conditions contributed to laxity of development the past week in major fields, with Buckeye of Gladwin County accounting for only five new oil wells, two of which were reported holes full of oil and scheduled for acid treatment.

Of significance in the south Buckeye (Oard) pool was an apparently dry test, which failed to respond after repeated acid treatments. It was Truss Petroleum Co. No. 3 McMahon, NE SW NW section 25-18n-1w. It probably will be abandoned. Though flanked by favorable producers, the test showed no indication of commercial production. Section 25 is the discovery section of the Oard pool, and while it never was regarded as heavy in commercial potentialities, it nevertheless has been fertile territory.

To the east, in section 24, Sun Oil Co. listed a failure at its No. 1 Shumway, SW NW SE section 24-18n-1w, after finding the Dundee dry.

Marshall Bauman No. 1 Hostetler, NE NE NE section 27-18n-1w, which developed better than 500 bbls. natural flow a week ago, to open up a new territory in Buckeye, was acidized the past week and stepped up production to 800 bbls. daily. Offsets to the Bauman well are in preparation.

In other parts of section 25 there were two completions last week. Rex Oil & Gas Co. No. 1 Gray, NW NW NW section 25-18n-1w, was acidized to a production of 450 bbls. daily, having increased its production from 130 bbls., natural flow. Bell & Blunt No. 2 McMahon, SW NW SW section 25-18n-1w, was reported with 2,500 feet of oil in the hole, and is scheduled to be drilled in this week.

Rowmor Corp. No. 1 Foster, NE SE NW section 26-18n-1w, gauged 300 bbls. after acid, the third completion of the week in the south field.

North Buckeye (Wicklund) charted only two completions for the week. D. J. Hart No. 3 Soldan, NW NE SE section 12-18n-1w, was reported a hole full of oil and was to be acidized. T. F. Caldwell No. 3 Emmott, SW SE SE section 12-18n-1w, was a 200-bbl. natural producer, and represented the only other north pool completion of the week. Many tests were reported to be holding back operations until transportation facilities improve with better roads into locations.

Bentley Township

Mammoth Producing & Refining Co. added two apparent producers to the Bentley field, Gladwin County, last week, neither of which was complete, but both of which gave favorable indications of further proving the Bentley field. Mammoth No. 1 La-Furgey, SW SW NE section 20-17n-2e, was reported with 3,000 feet of oil in the hole. It was scheduled for deepening and may be acidized. The second Bentley test was the company's No. 1 Lake, SE SE SE section 20-17n-2e, also incomplete, but reported on top of the Dundee with favorable indications. The Dundee was reported higher than in surrounding wells.

Gulf Refining Co. No. 1-A State, SE SE SW section 20-17n-2e, was preparing for acid after a good showing of oil. Approximately 70 bbls. of oil was swabbed from the hole. The one Bentley failure of the week was Swanson Oil Co. No. 1 Vantick, NE NW NW section 30-17n-2e, which was listed as a Dundee failure, and was scheduled to be plugged.

Secord Township

Favorable indications were reported at Sun Oil Co. No. 1 Conrad, NW NW SW section 12-19n-1e, Secord Township, Gladwin County, which was cased on the Dundee and was drilling in. Structural indications were favorable for a commercial producer, it was said.

Allegan County

Michigan Devonian Petroleum Co. reported a 200-bbl. natural producer at its No. 2-B Goodman, NE NE NE section 21-4n-13w, Salem Township, Allegan County, as the leading new Allegan producer of the week.

Midland County

Chapman Oil Co.'s Edenville, Midland County, discovery well continued to produce while tightly pinched, as removal of oil from the storage tanks was handicapped by road conditions. Its pinched-in production was reported at about 300 bbls. daily. Sun Oil Co. was prospecting on two other Edenville Township locations near the Chapman well. Sun No. 1-B State, C N half SE NE section 5-16n-1w, was cleaned out after a nitroglycerin shot, and reported pump production. This well is 4 miles north and 2 miles west of Chapman's. Another Sun test, its No. 1 Consumers Power Co., NE NE NE section 9, a southeast diagonal offset of the No. 1-B State, was reported drilling ahead at 3,300 feet.

Isabella County

A small gasser and an acidized oil producer were added the past week to the Broomfield area in Isabella County. Pure Oil Co. No. 11 Willie, NW NW NW section 4-14n-6w, gauged 180 bbls. after acid, and Michigan Cities Natural Gas Co. No. 1 Rhode, C S half S half section 11, brought in a 250,000-foot gas well, which will be hooked into the reserve supply of the Gas Corp. of Michigan.

Montcalm County

Smith Petroleum Co. No. 1 Williams, SW SW SE section 17, Douglas Township, Montcalm County, scheduled as an oil test, hit 1,100,000 feet of gas en route to the oil stratum. Drillers were cementing off the gas flow before continuing the oil exploration.

Ionia County

Rex Oil & Gas Co. No. 1 Marion, NE NW NW section 11, North Plains Township, Ionia County, was completed dry last week.

Clare County

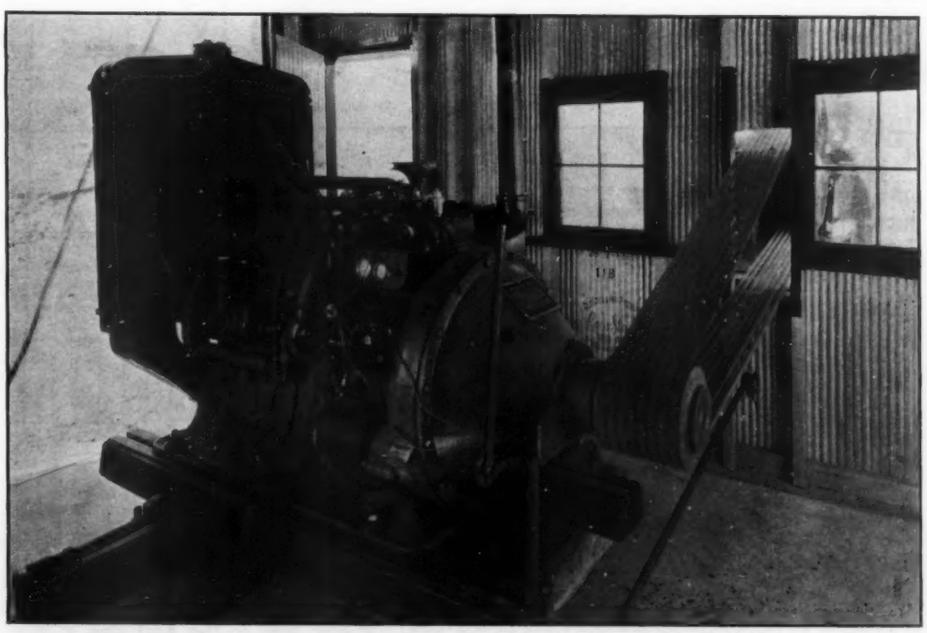
The biggest gas well in many months in Michigan fields, brought in by Gulf Refining Co. at its No. 1 Citizens State Bank and William Klingerer, NW NW NW section 36-17n-4w, Grant Township, Clare County, finally was capped after running wild for five days with a flow gauged at 18,600,000 feet. It will be connected with the nearby transmission line of Gas Corp. of Michigan, which supplies Clare and Mount Pleasant. Gulf Refining plans to drill again nearby for its oil test of the Dundee limestone.

Edenville Attracts Exploration

The Edenville area opened up by the 1,000-bbl. discovery of Chapman Oil Co. appears due for thorough exploration, for since the Chapman strike January 30—despite almost impossible weather conditions—rigs have been erected and drilling has begun in five other nearby locations. The Chapman company has begun north and south offsets of the discovery well, while Mammoth Producing & Refining Co. has started a west offset, Sun Oil Co. has a test under way two locations south and Smith Petroleum Co. another two locations north.

Ten Drill Licenses Issued

The state conservation department issued the past week drilling permits for 10 wells, 2 in Arenac County, 2 in Midland, 1 in Ogemaw, and 5 in Gladwin. The Arenac tests are divided between the Adams and Clayton fields. Both the Midland tests are in Edenville Township, while Gladwin's five are divided between Bentley, Buckeye and Sage townships.



Multi-cylinder gas engine pumping well in Kansas. This type reduces load shock

Southwest Texas District

Pool Opened in Bee County; Good San Patricio Prospect

By F. L. SINGLETON

CORPUS CHRISTI, Tex., Feb. 21.—The opening of a new pool along the Jackson trend in Bee County and the testing of several important wildcats, held attention of operators throughout the Southwest Texas district.

Dirks Brothers No. 1 Mangus Beck, 1½ miles north of Normanna, Bee County, was completed for an initial production of 60 bbls. through a 5/32-inch choke with 300 pounds tubing pressure and 625 pounds casing pressure. The hole is bottomed in the Pettus sand at 4,273 feet and production was obtained by perforating the casing at 4,215-23 feet. The field has been given the name "North Normanna" and it is located in section 17 of the Chittem Miller Ranch Subdivision, in the J. M. Urangas Grant.

Final completion of Hantho-Nelson, Inc., No. 1 Alma McNeil, a prospective pool opener in Live Oak County has been delayed by a 10-foot bridge in the bottom of the casing. The bridge is being drilled out and a production test will be made this week. The hole is bottomed in the Pettus sand at 5,076 feet with good saturation logged at 5,061-73 feet and from 5,073 feet to the total depth. Location is 4 miles south of the county line in the Alexander Parks Survey.

In Jim Wells County, 5 miles southwest of Alice, H. H. Howell No. 1 Otto Goldapp was showing for a distillate producer after it blew out of control when tested at the close of the week. Saturated sand was logged at 3,615-34 feet, the total depth and as it appeared to be a small producer, the tubing was pulled and the casing perforated at 3,550-60 feet. The well began to show considerable gas pressure after the perforations were made and it got out of control for several minutes, spraying distillate and showing an estimated 2,000 pounds of pressure. At the close of the week, operators were attempting to bring it under control. On a drill stem test last week, from 3,585-3,634 feet, it filled several hundred feet with pipe line oil and 140 feet with salt water. This is the second test in the area, and is an east offset to the operator's No. 1 Talbott, temporarily abandoned several weeks ago, after indicating a small producer.

Prospective Pool Opener

Preparations were being made by Plymouth Oil Co. to complete No. 1 Brigham, a prospective pool opener east of the White Point gas field in San Patricio County. Casing was cemented on bottom at 5,665 feet, after a 10-minute drill stem test at 5,650-65 feet recovered 900 feet of oil and 125 pounds of drilling mud having a brackish taste. The hole is bottomed in the Frio formation and additional showings were logged from 5,630 feet. The South Texas Geological Society has named the field "East White Point." Material is being moved in by Smith Drilling Co. for No. 1 Mrs. William French, about 3,000 feet southeast of the above well and in section 65 of the Coleman-Fulton Pasture Co. lands. An active development program is anticipated owing to the fact that protection leases are held by numerous companies. Southeast of Gregory, additional showings continue to be reported at A. L. Bob No. 2 Green, Firm sand with gas and distillate odor was logged at 6,797-6,814 feet.

Renwar Oil Corp. No. 1 Rand Morgan, 1 mile southwest of the discovery well of the West Saxet field, Nueces County, reached the discovery horizon and prospects of an extension were not promising. The hole is bottomed at 5,837 feet and a Schlumberger survey was being made. Firm sand and sandy shale carrying an odor of oil was cored at 5,829-37 feet. The discovery well is producing from the Frio formation at 5,810-12 feet. Rutherford Oil Corp. No. 1 Stewart, a half mile west of the discovery had drilled to a total depth of 6,512 feet with no showings reported. It is scheduled to be drilled to 7,000 feet before the hole is abandoned.

Locations for two important wildcats were made and immediate drilling is expected. Approximately 1½ miles east of the south end of the Saxet field, Richardson Petroleum Co. staked No. 2 H. B. Galdwin in Block 5 of the J. C. Russell Farm Block in the E. Villareal Survey, Abstract No. 1. West of London, in the O. & M. Oliver Survey, section 156, Corpus Christi Refining Co. is preparing to spud No. 1 J. R. H. Howingston.

Porter Regenold Maps, Corpus Christi

Plymouth Oil Co. No. 1 Brigham, a prospective pool opener in San Patricio County, and its relation to the White Point gas field to the west. A dry hole to the east and a new location to the southeast is also shown

Will Drill in Bay

The first well to be drilled in Laguna Madre Bay bordering the Flour Bluff field, was spudded the past week by Humble Oil & Refining Co. on State Tract No. 13. It offsets the company's No. 6-A Miller, approximately 400 feet west. In the Luby field, Seaboard Oil Corp. No. 12 James flowed 152 bbls. through a one-eighth inch choke with 800 pounds casing pressure and 905 pounds tubing pressure. The hole is bottomed at 5,068 feet, and production is from perforations at 5,058-66½ feet. No. 8 Luby is bottomed in oil sand at 5,068 feet, and 7-inch casing is being cemented.

In the South Clara Driscoll field, Nueces County, Wellington Oil Co. and Seaboard Oil Corp. No. 1 Dugger was drilling below 4,702 feet. The well is believed to have opened a new sand for the field as a previous drill stem test at 4,648-57 feet showed 120 feet of oil and 25 pounds of working pressure. No showings were logged in the discovery horizon at 3,900 feet.

Offsetting the discovery well of the East Telferner field, Victoria County, Harry L. Edwards was running casing for a production test after plugging back from a total depth of 5,624 feet to the discovery horizon at 5,100 feet. Oil sand with a salty taste was cored at 5,612-24 feet, but a drill stem test failed due to the seat failing to hold. A drill stem test at 5,170-88 feet showed 1,620 feet of salt water, with no pressure. The production test is scheduled to be made around 5,114-29 feet where 300 feet of oil and several hundred feet of salt water was recovered on a previous test.

Fault Line District

Along the Balcones Fault Line district, interest was centered on three wildcats in Dimmit, Maverick and Caldwell counties. Paul Teas and others No. 1 McKnight, an Edwards lime test on Block 13, section 23, I.&G.N. Survey, Maverick County, is reported to have cored saturated lime at 7,038-65 feet and drilling was discontinued to run casing. The top of the Dobie lime was topped at 7,038 feet. Additional cores were taken at 7,105-10 feet, with no recovery, while at 7,110-16 feet, the total depth, small fragments of hard grayish black lime with a slight odor were recovered.

In Maverick County, Wellington Oil Co. is running 7-inch casing in No. 1-A Chittim. Showings of oil and

gas were found throughout the Austin chalk and Buda lime. Tubing was run to 2,697 feet, the total depth, and the well flowed oil and drilling mud for 55 minutes. The casing will be cemented at approximately 1,500 feet which is the top of the Chalk formation. This is the third well to be drilled on a block of approximately 375,000 acres which is located approximately 3,000 feet east of the Chittim gas field.

Two miles west of Tilman in the W. House Survey, Caldwell County, Mac-Wag-Tree Oil Co. is running tubing to test after favorable showings were logged in the Dobie and the Edwards lime formations. The best showing in the Dobie formation was cored at 2,703-12 feet while in the Edwards, a good showing was logged at 2,713 feet.

COMPLETED WELLS

Completed wells in proven Southwest Texas fields, with their total depth, and the initial 24-hour production of the producing wells, were as follows:

Aransas County

McCampbell field: Atlantic Refining Co. No. 10-B Porterfield, 7,128 feet, 150 bbls., three-sixteenths inch choke. Danrey Oil Co. No. 2-A Hays, 7,168 feet, 125 bbls., three-sixteenths inch choke.

Caldwell County

Dale field: Ralph Ogden No. 2-B Lackey, 2,662 feet, 54 bbls., 12 hours pumping. Luling field: J. B. Leggett No. 1 Hardeman, 2,190 feet, 30 bbls. oil, 50 bbls. water, pumping; Taylor Refining Co. No. 1 Grady, 2,169 feet, abandoned. Salt Flat field: Ellmag Oil Corp. No. 1 Dickerson, 2,724 feet, 35 bbls. oil, 350 bbls. water, pumping.

Duval County

Benevides field: Benedum & Trees No. 10 Puig, 4,830 feet, perforated casing 4,763-70 feet, 136 bbls., 5/32-inch choke. Hiawatha Oil & Gas Co. No. 7 Parr, 4,749 feet, 170 bbls., 5/32-inch choke. Glenn H. McCarthy No. 2 Plocker, 5,400 feet, 212 bbls., quarter-inch choke. Navarro Oil Co. No. 2 Rossi, 5,369 feet, 384 bbls., quarter-inch choke. Parr & Delaney Oil Co. No. 8 Vaello, 4,828 feet, perforated casing 4,761-71 feet, 158 bbls., three-sixteenths inch choke. Southwood Oil Co. No. 4 Rossie, 3,903 feet, sand 3,820-3,878 feet, initial production 15,000,000 feet of dry gas. Standard Oil Co. of Kansas No. 5 Walstead, 5,361 feet, 135 bbls., quarter-inch choke.

Hoffman field: Cox & Hamon and others No. 2 Cuellar, oil sand 2,552-2,573 feet, 75 bbls., jetting. Cox & Hamon No. 1 Hoffman, oil sand 2,766-68 feet, 172 bbls., jetting; No. 5 Cuellar, 2,568 feet, 35 bbls., jetting. Labbe field: Magnolia Petroleum Co. No. 3 Murphy, 2,952 feet, abandoned. Sarnosa field: Magnolia Petroleum Co. No. 6 Ruiz, 2,547 feet, abandoned. Seven Sisters field: Reynosa Oil Co. No. 4 Garza oil sand 1,480-84 feet, 102 bbls., nine-sixteenths inch choke.

Hidalgo County

Samfordyce field: R. E. Fair No. 2-A Pena, oil sand 2,961-81 feet, 198 bbls., quarter-inch choke.

Karnes County

South Burnell field: Luling Oil & Gas Co. No. 20 Boyce, 3,636 feet, 78 bbls., 5/32-inch choke.

Live Oak County

Ezzell field: E. M. Jones No. 1-F Ezzell, 1,529 feet, 154 bbls., pumping. L. W. Powell and others No. 1 House, 1,479 feet, 20 bbls., pumping.

Nueces County

Flour Bluff field: Humble Oil & Refining Co. No. 16 Webb, 6,666 feet, 138 bbls., quarter-inch choke. Luby field: Seaboard Oil Corp. No. 10 Luby, 5,067 feet, perforated casing 5,060-66 feet, 167 bbls., one-eighths inch choke. Seaboard Oil Co. No. 4 Shaefer, 5,071 feet, 150 bbls., one-eighth inch choke. Saxet field: Kepley Production Co. No. 1 Donigan, 4,174 feet, 120 bbls., three-sixteenths inch choke.

Refugio County

Refugio field: Houston Oil Co. No. 36 Rooke, 6,224 feet, 241 bbls., 5/32-inch choke. Tomoconnor field: Nordan & Morris No. 24-C O'Connor, 5,925 feet, perforated casing 5,863-69 feet, 1,396 bbls., three-sixteenths inch choke.

Webb County

Killam field: Gravis and others No. 1 Martinez, 2,004 feet, abandoned. Oilton field: Cox & Hamon No. 3 Wise, 2,002 feet, 240 bbls., one-half inch choke. J. R. B. Moore No. 5 Martin, 1,895 feet, 50 bbls., one-half inch choke.

Victoria County

Heyser field: Blanco Oil Co. and Buchannan No. 7 C. S. Dunwoody, 5,501 feet, 315 bbls., three-sixteenths inch choke. Gulf Oil Corp. No. 2 Schultz, 5,491 feet, perforated casing 5,485-88 feet, 111 bbls., 9/64-inch choke. Sinclair Prairie Oil Co. No. 8 W. H. Bennett, 6,048 feet, perforated casing 5,486-96 feet, 99 bbls., 9/64-inch choke. Magnolia Petroleum Co. No. 3 Lander, 5,745 feet, 199 bbls., 9/64-inch choke. McFaddin field: Barnsdall Oil Co. No. 4 McFaddin, 4,394 feet, 97 bbls. 16 hours, one-eighth inch choke. Transwestern Oil Co. No. 4-A McFaddin, 4,488½ feet, perforated casing 4,469-72 feet, dry gas well.

East Texas Fields

(Continued from Page 248)

6 fee, 3,736-38 feet, 2 bbls. A. O. Phillips No. 2 Victory, 3,616-18 feet, 30 bbls. J. A. Woods No. 4 A. B. Mackey, 3,720-32 feet, 30 bbls.

Gregg County

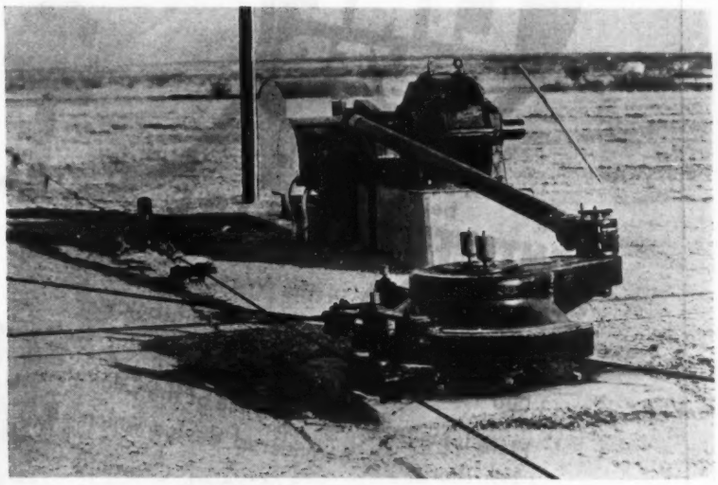
(Initial gauges in barrels per hour)

Fain-McGaha No. 12 Bouknight, 3,538-87 feet, 60 bbls. General American Oil Co. No. 19 Adams, 3,567-75 feet, 75 bbls.; No. 24-A McGrede, 3,630-38 feet, 65 bbls.; No. 16-A Sheppard, 3,564-72 feet, 64 bbls. Humble Oil & Refining Co. No. 13 Clements, 3,559-92 feet, 54 bbls. Margay Oil Corp. No. 11 Christian, 3,661-66 feet, 60 bbls. Marine Production Co. No. 7 Richey, 3,546-72 feet, 80 bbls. Stanolind Oil & Gas Co. No. 4 Lee, total depth 3,620 feet, dry and abandoned. Stanolind-Atlantic No. 19 Harp, 3,510-63 feet, 51 bbls. Stanolind-Tide Water No. 29 Persons, 3,488-3,549 feet, 50 bbls. W. F. Turner No. 13 Jones, 3,606-56 feet, 60 bbls. Gulf Oil Corp. No. 15 Reeves, 3,576-83 feet, 50 bbls. Jimmie Kemp No. 1 Laird, 3,522-30 feet, 40 bbls. Roger Lacy No. 13 Reynolds, 3,531-51 feet, 15 bbls.; No. 14 Reynolds, 3,532-57 feet, 30 bbls. Magnolia Petroleum Co. No. 39 Rodford, 3,600-03 feet, 60 bbls.; No. 7 Sheppard, 3,585-90 feet, 30

DURNELL UNIVERSAL PUMPING UNIT

Patented and Patents Pending

- Operates from back crank of bandwheel operating key well with pumping beam.
- Operating from bandwheel set as a separate central power, either one or two units can be driven.
- Operates direct from gear reduction, either singly or in pairs.
- Operates from back crank where gear unit is pumping key well through standard pumping beam.



Reduction gear driven type operating six 2800 foot wells

Universal Installation, Operation, and Application

Back crank type operating several wells from key well power

This Unit requires no special housing—wells can be driven direct from the unit WITHOUT the use of swings. Rod line connections are so arranged that lines from various directions do not interfere. The method used in connecting rod line to unit permits load to be balanced on even number of wells. These units have proven their practicability and economy in the fields of Wyoming, Kansas, New Mexico, Oklahoma, and Texas.

For detailed information write, wire, or phone 711.

UNION MACHINE CO.

BARTLESVILLE, OKLAHOMA

bbls. Sun Oil Co. No. 10 Strong, 3,603-46 feet, 47 bbls.

Rusk County

Francis Oil Co. No. 78 Scoggins, 3,661-62 feet, 40 bbls. Humble Oil & Refining Co. No. 15 Minor, 3,684-85 feet, 65 bbls.; No. 11 Reid, 3,620-89 feet, 60 bbls. Stanolind-Noble No. 8 King, 3,692-3,773 feet, 59 bbls. Pearson Investment Co. No. 1 Sanders, total depth 3,765 feet, dry and abandoned. Duo Oil Co. No. 4-A Thrash, 3,680-91 feet, 30 bbls. hourly. General American Oil Co. No. 12 Thompson, 3,743-54 feet, 60 bbls. Gulf Oil Corp. No. 7 Crim, 3,796-3,801 feet, 20 bbls. David Hanover No. 2 Johnson, 3,808-90 feet, 20 bbls. Humble Oil & Refining Co. No. 7 Brightwell, 3,702-14 feet, 70 bbls.; No. 59-A Silvey, 3,611-80 feet, 60 bbls. Milford Oil Co. No. 10 Thrash, 3,714-35 feet, 60 bbls. Shell Petroleum Co. No. 19-A Brooks, 3,668-3,725 feet, 45 bbls. Staley Oil Co. No. 12 Hale, 3,644-3,722 feet, 60 bbls. Tex-Canadian Oil Co. No. 14 Jackson, 3,722-27 feet, 50 bbls. Tide Water Associated No. 27 Pinkston, 3,786-3,814 feet, 60 bbls.; No. 3 Thrash, 3,704-31 feet, 60 bbls. Ward Oil Co. No. 37 Thrash, 3,787-3,832 feet, 40 bbls.

Upshur County

Texfield Oil Co. No. 1-A Skelton, 3,730-32 feet, 20 bbls.; No. 9 Skelton, 3,722-24 feet, 20 bbls.

L. & G. Oil Co. No. 1 Williams, dry and abandoned, total depth 4,009 feet.

EAST CENTRAL TEXAS COMPLETIONS

Anderson County

Humble Oil & Refining Co. No. 4 J. F. Roberts, in the Boggy Creek field, dry and abandoned at total depth of 3,745 feet.

H. L. Parsons and others No. 1 Hemby, 45,000,000 feet of gas, total depth 5,487 feet.

Angelina County

C. E. Parrott No. 1 J. C. Burris, derrick, abandoned.

Franklin County

In the Talco field, Humble Oil & Refining Co. No. 4 Stewart, 4,130-4,289 feet, 376 bbls. per day. Magnolia Petroleum Co. No. 6 Maxton, total depth 4,300 feet, 15 bbls. daily; No. 12 Owings, 4,170-4,300 feet, 330 bbls. per day.

Bowie County

King Oil Corp. No. 1 W. W. Ames, dry and abandoned at total depth of 4,480 feet.

Cherokee County

Gray & Wolfe No. 1 Dupre, total depth 5,170 feet, dry and abandoned.

Freestone County

Amerada Petroleum Co. No. 3 Berk, 3,012-24 feet, 148 bbls. per day.

Henderson County

Harden & Turner No. 1 H. W. Barton, 4,027-45 feet, 140 bbls. per day.

Titus County

Humble Oil & Refining Co. No. 4 Kirkpatrick, 4,230-36 feet, 193 bbls. per day.

Humble Oil & Refining Co. No. 3 Groves, 4,188-4,326 feet, 621 bbls. per day.

NORTH TEXAS COMPLETIONS

(Week ending February 12)

Archer County

T. H. Brown and others No. 1 Mrs. Anna B. Wallace, 1,773-85 feet, 15 bbls. Fraser & Proctor No. 2 W. M. Coleman, 1,403 feet, dry. W. Nazro No. 1 W. P. Ferguson, 3,790-3,867 feet, 670 bbls. Rathke Oil Co. No. 4 S. L. Scott, 1,254 feet, dry.

Clay County

Bridwell Oil Co. No. 1 T. C. Thornberry, 1,092-1,115 feet, 125 bbls. W. H. Metzner No. 5 J. J. Taylor Estate, 1,092-1,121 feet, 145 bbls.; No. 6 J. J. Taylor Estate, 1,092-1,118 feet, 150 bbls. Seitz, Comegys & Seitz No. 1 Luther Wright, 4,112 feet, dry.

Cooke County

Kingery Brothers and others No. 3 Alice Johnson, 1,178-1,215 feet, 110 bbls. Pace Petroleum Co. No. 4 J. R. Winstead B, 1,170-1,215 feet, 120 bbls.

Jack County

R. D. Compton Oil Co. No. 15 Charles Henderson, 308-40 feet, 100 bbls. Josaline Production Co. No. 3 J. A. Beasley, 2,890-2,965 feet, 25 bbls. O. J. Perrin No. 2 J. S. Rhodes, 3,029-99 feet, 650 bbls.

Wichita County

Blackwell Oil & Gas Co. No. 3 W. L. Hodges, 3,680-3,861 feet, 207 bbls. in three hours. Perry Browning and others No. 1 G. W. Lewis, 3,635-3,775 feet, 81 bbls. in three hours. L. T. Burns No. 1 First National Co., 3,658-3,855 feet, 150 bbls., 24 hours. Consolidated Oil Co. No. 3 W. P. Ferguson, 3,695-3,760 feet, 642 bbls., 24 hours. Deep Oil Development Co. No. 7 First National Co., 3,636-3,837 feet, 103 bbls. in three hours. Dinsmore & Stipe No. 11 S. B. Burnett and others, 528 feet, dry hole. E. C. Oil Co. No. 1 W. H. Hodges, 3,728-3,817 feet, estimated 610 bbls., 24 hours. Kadane Griffith Oil Co. No. 3 Mrs. Anna Mangold A, 3,709-77 feet, 248 bbls., 24 hours. Lewis Production Co. No. 1 Wichita National Bank, 3,669-3,747 feet, 210 bbls. in three hours. Reed Glass & Crenshaw No. 5 First National Co., 3,621-3,815 feet, 94 bbls. in three hours. Staley Oil Co. No. 1 W. P. Ferguson, 3,799-3,845 feet, 594 bbls., 24 hours.; No. 1 J. M. McFall, 3,863-4,000 feet, 35 bbls., 24 hours. Perkins & Cullum No. 12 S. B. Burnett and others, 1,532-50 feet, 40 bbls.

Wilbarger County

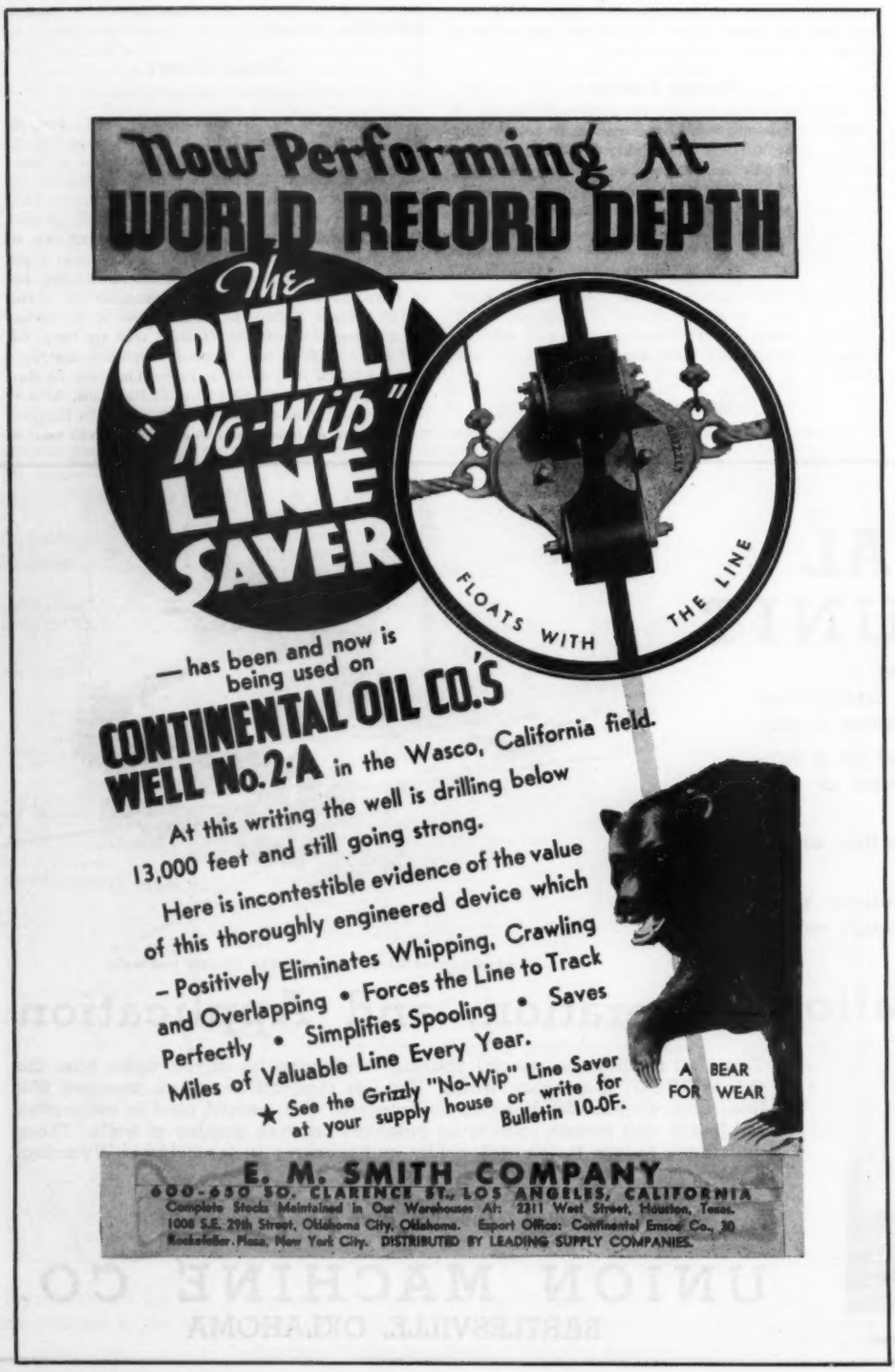
J. B. Baker, Jr. No. 2 W. T. Waggoner H, 1,143 feet, dry. L. Webb No. 2 W. T. Waggoner D, 2,360-2,672 feet, 135 bbls., 24 hours.

Young County

Cable Oil Co. No. 40 L. A. Snider, 607-20 feet, 10 bbls. W. C. Green No. 1 W. E. Edwards, 975 feet, dry. J. G. Steele No. 1 G. W. Davis, 2,852-3,687 feet, plugged back 3,200 feet, 87 bbls.

Reported Oil Discovery in Punjab Area in India

A representative of the Burmah Oil Co. has been dispatched to the Suleman Mountain area of Punjab, India, to investigate reports reaching the exterior that oil had been discovered near Fort Munro.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West, Central and Panhandle Texas

By MITCHELL TUCKER

Slaughter Appears to Be on a Large Producing Structure

FORT WORTH, Tex., Feb. 21.—The Slaughter field of Hockley County, one of the northernmost fields in the Permian Basin, which was discovered in 1937 and has remained a three-well pool largely because of no pipe line outlet, quickly assumed the position of greatest interest last week. A 2-mile northern extension gives all the appearances of another large West Texas producing structure. Sid W. Richardson of Fort Worth, No. 1 Slaughter, southwest corner of Labor 59, League 39, Maverick County School Land, drilled and cored saturated Permian lime at 4,93C-94 feet, and responded to a 380-quart shot at 4,895-4,989 feet by gauging 260 bbls. of oil in 11 hours.

Gulf Oil Corp. is bringing its west and east extension tests in the Slaughter field rapidly to the testing stage. No. 1 Mallett, 2 miles southwest of production, has had the upper markers favorably, and drills ahead below 4,726 feet, expecting to core for the pay section soon. One mile southeast of production, Gulf's No. 1 Gordon has had the lime top 30 feet higher than the present outpost producer in that direction, and is also preparing to core for saturation. Slaughter's trend is 4 miles long at this time, spreading in the northwest-southwest direction down to the northern line of Terry County. Although the field still lacks a pipe line outlet, increased activity is expected in this area.

Bennett Pool

Adding to the growing interests in the North Permian Basin fields, the Bennett field of Yoakum County recorded its largest producer since its discovery in 1937. Texas Pacific Coal & Oil Co. No. 4 Bennett flowed at the rate of 2,156 bbls. daily following a 720-quart shot from 5,080-5,275 feet, total depth. Some geologists are beginning to contour this field with the Wasson area 5 miles southwest, which if correct, would indicate many thousand proven acres situated between the two producing pools.

Foremost among the interesting new wildcats for the North Basin territory was the Texas Co. No. 1 Mollett Land & Cattle Co., section 7, Block G, Public School Land in southeast Cochran County. The test will be especially interesting due to its midway position between the Duggan and Slaughter fields, being 8 miles west of Slaughter production and 5 miles southeast of Duggan producers.

The one-well field opened by Bohago & Bond in October, 1937, in southern Yoakum County, came again to the front when two extension wells to the southeast cored saturation last week, and prepared to test. The discovery operator's No. 1 J. L. West, 1½ miles east by southwest of their initial well, has recovered saturated cores from 5,286-5,302 feet, and 7-inch casing has been cemented for testing at a depth of 5,230 feet. Ohio Oil Co. No. 1 L. N. Clawater, 2 miles southeast of production, logged saturation, but slight porosity, in lime at 5,220-64 feet, and following a 7,000-gallon stage acid treatment, the well is now swabbing at the rate of about 1 bbl. hourly.

In central Gaines County, Amerada Petroleum Co. No. 1 Robertson, continued to afford encouragement as a possible 1-mile eastern extension of the Seminole field. At a total depth of 5,018 feet, in lime, the lower 8 feet showed saturation and an initial 3,000-gallon acid charge was given. Swabbing operations are now underway in an effort to establish the well's productivity.

A. G. Carter and others No. 1 Gresecke, a wildcat in southeastern Gaines County, found only sulfur water in porous lime at 5,485 feet, and was abandoned after drilling to a depth of 5,800 feet.

Ordovician Prospects

Magnolia Petroleum Co. and Tex-Mex No. 1-A McKee, in the Imperial area in northern Pecos County, cemented 7-inch casing on bottom at 5,294 feet in preparation to drill ahead. Formerly this well made several impressive flows from a 9-foot section of Simpson sand, 5,271-80 feet.

Sixty miles south in Pecos County, Stanley A. Thompson No. 1 Elsinore, is cleaning out cavings and preparing to drill ahead at 7,128 feet in or near the Pennsylvanian-Simpson contact point.

Ordovician Oil Co. No. 1 J. T. Evans in southern Sutton County is to be plugged after drilling to 4,188 feet and striking salt water in the bottom Ellenburger (lower Ordovician) from 4,073 to 4,188 feet.

Floyd C. Dodson and others No. 1-A Texas American Syndicate, a wildcat in northwestern Brewster County, continues to drill ahead in the Simpson formation below 7,440 feet.

Tex-Tor Oil Corp. No. 1 Judkins & Spencer, eastern Schleicher County's bid for Ordovician production, has been shut down for orders at 6,207 feet, having found no favorable showings since entering the Ellenberger at 5,547 feet.

Humble Oil & Refining Co. No. 1 Lewis & Wardlow, having Ordovician production in western Tom Green County as its objective, is coring and drilling slowly ahead at 6,128 feet.

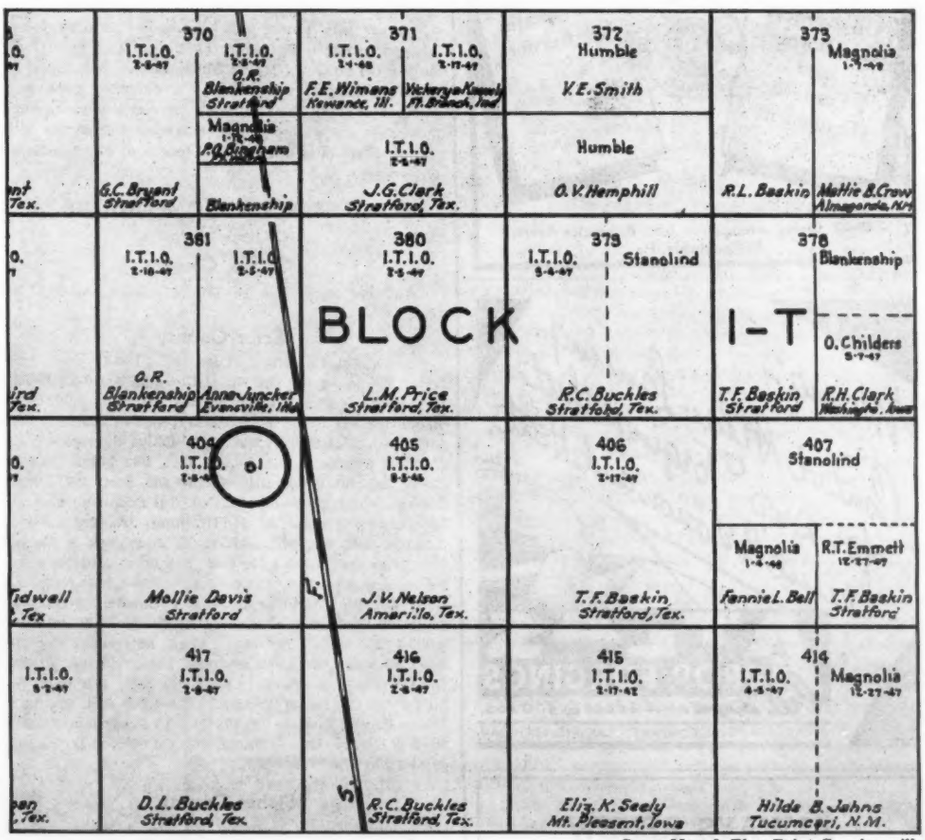
Ector County

Ector County's lead in drilling activity for the Permian Basin is not threatened as last week 15 wells were rigging up and 75 drilling in the county. The majority of this drilling is in the Harper, North Cowden, Goldsmith, Johnson, and Penwell fields. Of the 16 completions made last week, nine were in the Harper field, one of which was the largest producer yet completed. A. J. Broderick and George Calvert No. 2 Parker gauged 3,000 bbls. after shooting with 488 quarts, total depth 4,220 feet. The previous largest producer was same operators' No. 4-C Cowden, which gauged 2,415 bbls. per day initially.

The Harper field also joined the large group of West Texas field which are now receiving semiwildcat tests at outlying points, when York & Harper of Midland began preparations to drill a 2½-mile southwest outpost on lands taken on a farm-out basis from Sinclair Prairie Oil Co.

WEST CENTRAL TEXAS

Following Lone Star Gas Co.'s important Ellenberger discovery in its No. 1 Cozart, northwest of Cisco in Eastland County, recently completed as a 288-bbl. producer, several other tests are being drilled, or are planned, for the same horizon. Lone Star Gas Co. is drilling No. 1 Van Parmer, 800 feet to the east of Cozart No. 1, and moving in rig for No. 2 Van Parmer, 1,321 feet north. In an attempt to find the same Ellenburger production northwest, G. Willard Rich has made a location in the



Sears Map & Blue Print Co., Amarillo

Location of I. T. I. O.'s sweet-gas discovery in section 404, Block I-T, T.&N.O. Survey, northern Sherman County, about 20 miles north of Dumas, which has gauged 30,000,000 feet from the dolomite above 3,200 feet. This territory is promised an active wildcat campaign, situated favorably as it is between huge gas reservoirs both to the north and the south

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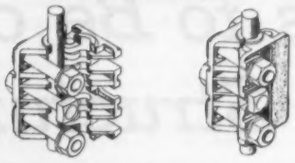

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extreme southwest corner of Stephens County for a 4,250-foot wildcat test in section 39-7, T.&P. Survey.

In the Oplin area of southwestern Callahan County, 30 miles southeast of Abilene, Hal Hughes and others No. 1 Poindexter shows promise of being a producer, and if so is expected to reopen the play for Ordovician production for that territory. Sample analysis of the Ellenburger there indicated 62 per cent lime from 4,368-89 feet, which will react favorably to acid. Complete acidization will be made next week and production tests made. Ever since 1920 the Oplin area has been considered favorable for Ordovician production, after Empire Oil & Gas Co. drilled an Ellenburger gusher making 1,000 bbls. a day for a short time before it was shot into water.

In southern Jones County, two Oklahoma City operators, Walter K. and R. D. Jones, plan to acidize their promising shallow wildcat discovery, No. 1 Ora Neas, in lime at 1,953-60 feet. Tanks have been erected. Location is 5 miles east of the Guitar field and 4 miles south of the Lewis pool, both shallow sand areas. Nearest production from the same lime pay is in the Hawley field 8 miles to the west.

PANHANDLE DISTRICT

Panhandle activities showed a considerable decline over the past week, partly because of inclement weather. There were only 10 completions recorded, as compared with 19 for the previous seven-day period. Eight wells were completed for oil, having an aggregate initial production of 3,049 bbls., and two were dry holes. New locations dropped to 13 for the past week, Carson County receiving one, Gray and Hutchinson counties receiving six each.

Sherman County

Sherman County, Texas, in the northernmost tier of Texas counties, promises to share prominently in future Panhandle developments. Situated as it is between the huge gas reservoir in Moore County to the south and the gas production developed in Texas County, in the Oklahoma Panhandle, together with the Hugoton, Kansas, gas fields to the north, Sherman County continues to enjoy an active leasing campaign with promises of several important wildcat tests during the spring months.

Apparently a new sweet-gas area has already been opened in Sherman County by Indian Territory Illuminating Oil Co. No. 1 Mollie Davis, section 404, Block 1-T, T.&N.O. Survey, which found a dolomite gas-bearing horizon above 3,100 feet, with increases down to about 3,200 feet, and gauged about 30,000,000 feet of gas daily. The well is being deepened in search of oil, its original objective.

WEST TEXAS COMPLETIONS

(24-hour gauges)

Crane County

Gulf Oil Corp. No. 15 Tubbs, 4,395-4,420 feet, 306 bbls.

Ector County

Pantex Oil Co. No. 3 Cowden, 4,110-42 feet, 1,181 bbls. Barnsdall Oil Co. No. 2 Cowden, 4,070-4,186 feet, 957 bbls.; No. 8 Foster, 4,010-4,170 feet, 1,092 bbls. Broderick & Calvert No. 2 Parker, 4,034-4,220 feet, 2,998 bbls.; No. 3 Parker, 1,964 bbls. Cities Service Oil Co. No. 7-B Cummins, 4,145-4,256 feet, 982 bbls. Gulf Oil Corp. No. 69 Goldsmith, 4,175-4,255 feet, 2,752 bbls. Humble Oil & Refining Co. No. 6-B Scharbauer, 4,206-55 feet, 1,732 bbls. W. H. Dunning, Jr., No. 2 Slater, 4,230-84 feet, 531 bbls. M. B. K. and York & Harper No. 1 Cowden, 4,105-4,270 feet, 828 bbls. Mid-Continent Petroleum Co. No. 2 Cowden, 4,639-4,246 feet, 933 bbls. Oil Well Drilling Co. No. 2 Cowden, 3,401-3,634 feet, 549 bbls. Schermerhorn Oil Co. No. 2-B Johnson, 4,035-4,125 feet, 1,095 bbls. Shell Petroleum Co. No. 6-B Cowden, 4,040-4,270 feet, 346 bbls. Sinclair Prairie Oil Co. No. 4 Johnson, 4,170-4,260 feet, 448 bbls. Superior Oil Co. No. 3 Cowden, 4,070-4,260 feet, 996 bbls. Texas Pacific Coal & Oil Co. No. 13 Scharbauer, 4,200-30 feet, 1,925 bbls. Wentz Oil Co. No. 4-D Parker, 4,014-4,230 feet, 1,909 bbls.

Fisher County

Danciger Oil & Refining Co. No. 1 Brown, abandoned location. Magnolia Petroleum Co. No. 1 J. M. Smith, abandoned location.

Gaines County

Amerada Petroleum Co. No. 1 Riley, 5,014-27 feet, 298 bbls. Carter-Continental No. 2-44 Moore-Langdon, 4,940-84 feet, 375 bbls.; No. 5 Wasson, 4,910-70 feet, 1,431 bbls. Continental Oil Co. No. 2-53 Wasson, 4,915-71 feet, 495 bbls.

Howard County

Continental Oil Co. No. 2-B Settles, dry and abandoned at 2,631 feet. Magnolia Petroleum Co. No. 3 O. Daniel, 2,591-2,800 feet, 594 bbls. Sinclair Prairie No. 53 Dodge, 2,305-2,770 feet, 330 bbls.; No. 1 Ruth Jones, dry and abandoned at 3,060 feet.

Mitchell County

Standard Oil Co. of Texas No. 1-6 Foster, dry and abandoned at 3,090 feet.

Pecos County

Aero Gas & Refining Co. No. 1 Johnson, dry and abandoned at 2,710 feet. Stanolind-Continental No. 21 Yates, 1,494-1,616 feet, 2,604 bbls.

Sutton County

Ordovician Oil Co. No. 1 Evans, dry and abandoned at 4,188 feet.

Upton County

Cardinal Oil Co. No. 11 Wooley, 2,161-74 feet, 127 bbls. Gulf Oil Corp. No. 11 Rogers, 2,176-98 feet, 446 bbls.

Ward County

Cities Service Oil Co. No. 2 Brandenberg, 2,044-92 feet, 40 bbls. Gulf Oil Corp. No. 79 Estes, 2,459-2,686 feet, 2,540 bbls.; No. 96 Hutchins, 2,519-2,760 feet, 1,439 bbls. Hoss & Downey No. 1 Meyers, location abandoned. A. E. Lynch No. 3-B Himmel, 2,296-2,396 feet, 183 bbls. Magnolia Petroleum Co. No. 2-46 Sealy, 2,998-3,040 feet, 125 bbls. C. S. Messenger No. 2 Landon, dry and abandoned at 2,603 feet. Pattillo & Schkade No. 1 Dour, dry and abandoned at 2,015 feet. Rixford and others No. 3 Green, location temporarily abandoned. West Texas Oil & Royalty No. 1-D University, dry and abandoned at 2,627 feet.

Winkler County

Harry Adams No. 7 Sealy, 3,056-3,157 feet, 364 bbls. Amerada Petroleum Co. No. 7-A Daugherty, 2,903-65 feet, 721 bbls. Humble Oil & Refining Co. No. 27-A Colby, 2,780-3,082 feet, 287 bbls. J. C. Maxwell No. 2 Daugherty, 2,800-2,954 feet, 599 bbls.

Yoakum County

Texas Co. No. 1 Willard, 4,842-5,085 feet, 618 bbls. Campbell & Ross No. 1 Whitehead & Wardlaw, 296-310 feet, 16 bbls.; No. 2 Whitehead & Wardlow, 283-310 feet, 10 bbls.; No. 3 Whitehead & Wardlow, 296-302 feet, 15 bbls.

WEST CENTRAL TEXAS COMPLETIONS

Jones County

Lewis Production Co. No. 2 B. J. Rutledge, dry at 1,927 feet, total depth. Ungren & Frazier No. 3-E Dorsey, 138 bbls. in 24 hours after 1,000-gallon acidization at 2,203-16 feet, total depth. Warren & Kraker No. 1 J. C. Shankles (old well plugged), dry at 2,002 feet, total depth.

Fisher County

General Crude No. 1 Terrell (old well plugged), dry at total depth 3,126 feet. Montour Production Co. No. 3 E. Smith, flowed 547 bbls. in 24 hours naturally from 3,545-63½ feet, total depth.

Shackelford County

Hickok & Reynolds No. 1-A Flippen (old well plugged), dry at 903 feet, total depth; No. 1-B Flippen (old well plugged), dry at 897 feet, total depth. Letwin & Lippitt No. 1 W. I. Cook, dry at 1,323 feet, total depth. King & Williams No. 1 Thorpe (was C. V. Welch), 1 bbl. oil per day from 420-33 feet, total depth. Owens-Snebold and others No. 3 D. A. Ivy, dry at total depth 2,011 feet. Charles J. Kleiner and others No. 1 J. P. Morris, dry at 3,303 feet, total depth.

Callahan County

R. F. St. John No. 1 A. F. Dyer, dry at 3,132 feet, total depth. Beams Drilling & Producing Co. No. 7-D Jackson, dry at 1,307 feet, total depth.

PANHANDLE COMPLETIONS

(24-hour gauges)

Gray County

Cambrian Oil Co. No. 1 East Cole, 3,192-3,240 feet,

(Continued on Page 265)

Texas and Louisiana Gulf

By
NEIL WILLIAMS

New Sands in Two Pools and Interesting Tests in Brazoria

HOUSTON, Tex., Feb. 21.—The announcement of two important wildcat locations for the Pearland area, Brazoria County, and the testing of an interesting wildcat and a new sand discovery in Matagorda County, were the featured developments along the Gulf Coast district the past week.

The staking of two locations in the Pearland area, north of the prolific Hastings field, Brazoria County, has attracted wide attention as machinery is being moved in for immediate drilling. East of Pearland, in the Thomas J. Green Survey, W. H. Christie and others are moving in material for No. 1 J. J. Settegast which will be drilled to a depth below 6,500 feet. Approximately one mile northwest in the D. M. Hunter Survey, Albert Plummer is preparing to spud No. 1 G. C. Street. This is an old prospect which has within the past several months been the scene of much leasing and royalty activity.

In the same county and in the Sandy Point field, Stanolind Oil & Gas Co. was preparing to run casing in No. 3 Fite after making a Schlumberger survey. The hole is bottomed at 6,500 feet. Gas sand was logged at 6,464-68 feet, and at 6,433-83 feet, while sand showing oil and gas was logged from 6,495-98 feet. The well is a west offset to No. 2 Fite in Block 45, and based on geological markers, it is about normal with No. 2 Fite.

In the McCrosky area, northern Matagorda County, Pierce Estate continued testing No. 1 fee after it showed for a small producer. Bottomed in the Marginulina formation at 6,626 feet, the fluid was swabbed down to 2,100 feet. The well flowed by heads for 55 minutes before going dead. At the close of the week the hole was being swabbed and was showing approximately 70 per cent oil and the balance salt water. Tubing pressure was zero and shut-in casing pressure was 300 pounds Casing was cemented last week at 6,614 feet, after a 10-minute drill stem test in a sidetracked hole at 6,617-24 feet, showed 200 feet of oil-cut drilling mud and 25 pounds of working pressure.

Discouraging Showing

Prospects for a second oil producer in the recently opened Fairbanks field, Harris County, were not bright as Amerada Petroleum Corp. and Stanolind Oil & Gas Co. prepared No. 1 Peters for a production test. The hole is bottomed in salt water sand at 6,894 feet and the casing is to be cemented on bottom. The most encouraging indications were logged at 6,824-44 feet. The Cockfield was topped at 6,540 feet, Discorbis Yeguaensis at 6,700 feet and Eponides Yeguaensis at 6,784 feet. The well is southwest of the discovery well in the W. B. Hamblins Survey. Approximately one mile east of the discovery well on the J. Clarkson Survey location was made by the two companies for No. 1 Elizabeth M. White.

On the northwest edge of the Houston city limits, new activity is getting under way in the Eureka field, a distillate discovery of 1935. Jack Frazier has rig up for No. 1 Vollmer-Neiman in the J. Reinerman Survey. It is about 1,000 feet southeast of the discovery well. Interest in this area waned after several failures were drilled. In the Crosby area, Humble Oil & Refining Co. No. 1 Rohlfs, an interesting wildcat in the J. Sellers Survey, is fishing at a total depth of 8,116 feet. The Cockfield was topped at 7,550 feet and the Upper Saline Bayou at 8,116 feet.

A prospective producer and a dry hole loomed in the recently opened southwest flank area of the Orange field, Orange County. Gulf Oil Corp. is running 7-inch casing in No. 1 F. Granger after topping the sand at 5,937 feet and coring the formation to a total depth of 5,951 feet. It is a south offset to the discovery well. The prospective size of this area was narrowed, with the showing of Ryan & Thompson No. 1 Mary Norwood, about a half mile northwest of the discovery well. The Norwood test logged salt water sand in the discovery horizon and is being deepened to approximately 6,500 feet, where it will be abandoned.

Galveston Bay Well

Standard Oil Co. of Texas and Salt Dome Oil Corp. No. 1 State, the discovery well of the Cedar Point field, about mile offshore from Chambers County in Galveston Bay, flowed 595 bbls. of 36.4-gravity oil on a 20-hour potential test through a quarter-inch choke with tubing pressure 900 pounds and casing pressure 1,190 pounds. No new locations have been announced by the companies, although drilling is planned on offset leases held by the Humble Oil & Refining Co.

To the northwest in the newly opened Cedar Bayou field, Merit Oil Co. is moving in material for No. 1 Mary Winfree several hundred feet northeast of the discovery well.

Locations for two wildcats in Jackson County were made by Humble Oil & Refining Co. for No. 1 J. R. Davis, section 20, I.&G.N. Survey, southeast of Lolita, while H. J. Porter has spudded No. 1 J. W. Faust in the Peter White Survey.

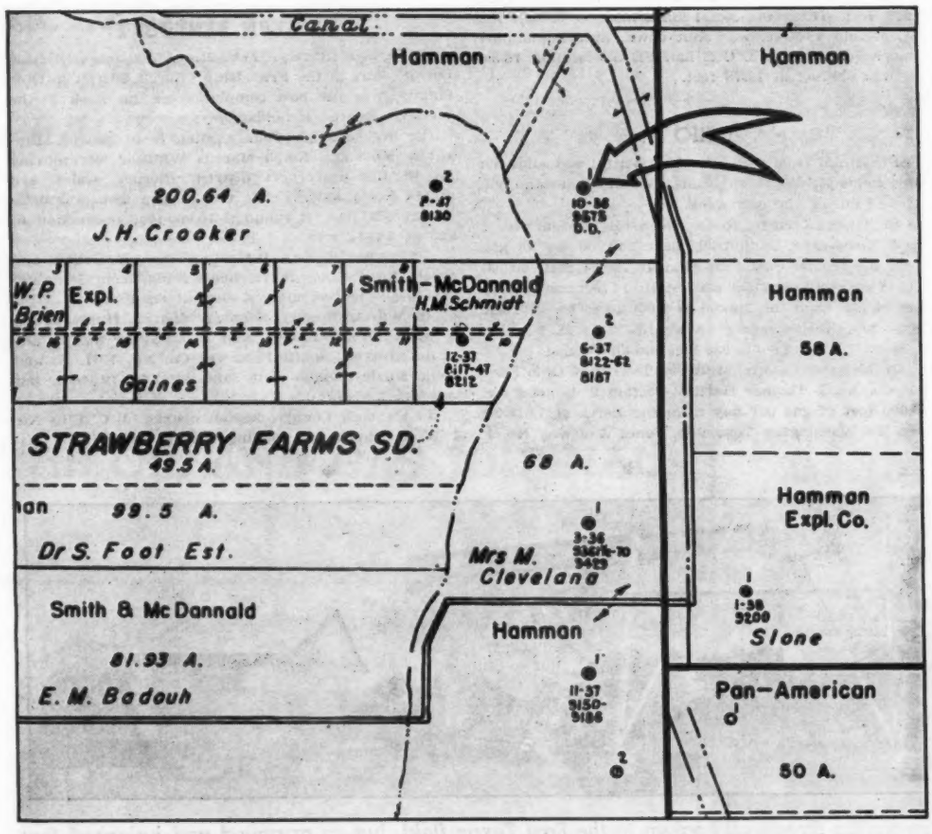
Deeper Sand at Bay City

The discovery of a deeper sand at the Bay City field, Matagorda County, enlarged the potentiality of that field, and may result in deepening of several wells. The new sand was found in Hamman Exploration Co. No. 1 J. H. Crooker, which topped the sand section at 9,660 feet, and later in the week was coring ahead in sand below 10,011 feet. This is believed to be the same section from which 10,000-foot production was developed at Old Ocean, several miles to the southeast in Brazoria County. No. 1 Crooker was originally completed through perforated casing at 8,190-94 feet, and was killed to drilled deeper, due to salt water encroachment. Within recent months, several of the wells originally completed in the 8,100, 9,100 and 9,300-foot horizons have been reworked, due to the encroachment of salt water and it is very likely that these will eventually be deepened should the above well be proven a good producer.

Development along the Louisiana Coast was comparatively quiet, although the staking of a third wildcat location at the North Starks Prospect in Calcasieu Parish attracted mch attention. Material is being moved in for Sun Oil Co. No. 1 Lutcher Moore Lumber Co., 4,731 feet from the south line and 1,622 feet from the west line of section 1-8s-13w. The location is about a half mile northwesterly from two dry holes recently drilled by Davenport and others, both of which logged several interesting showings.

In the Bayou Des Allemands field, St. Charles Parish, Amerada Petroleum Corp. is making a final completion attempt on No. 1 St. Charles Land Co., after a drillstem test through perforated casing at 6,783-87 feet showed salt water. The perforations have been squeezed off and the casing is to be perforated at 5,545-55 feet. The well is located 945 feet west of the discovery well and has the appearance of being a dry hole.

In the Bosco field, Acadia Parish, Superior Oil Co.



Bay City field, Matagorda County, showing location of Hamman Exploration Co. No. 1 J. H. Crooker which has found a new sand at 10,000 feet

No. 5 Larcade was completed through perforated casing at 8,075-85 feet for an initial production of 184 bbls. through an eight-sixty-fourths inch choke. The hole was drilled to a total depth of 10,434 feet.

New Sand at Lake Long

A new sand for the Lake Long field, Lafourche Parish was opened with the completion of Fohs Oil Co. No. 3 State, which made an initial production of 416 bbls. through a twelve-sixty-fourths inch choke, with tubing pressure 1,250 pounds and casing pressure 400 pounds. The hole was drilled to 11,347 feet, and was completed through perforated casing at 9,376-82 feet. The hole was plugged back to 10,123 feet and 5-inch casing was cemented on bottom. Location is 1,320 feet due north of the discovery well in section 65-17s-19e.

In the Lirette fied, Terrebonne Parish, Humble Oil & Refining Co. has abandoned No. 1 Wurzlow, about a half mile northwest of the discovery well. Bottomed at 11,347 feet, preparations were made to abandon after plugging back to 10,900 feet. The rig is being moved in for a second test on the Wurzlow lease in section 32, while Union Producing Co. is expected to start operation on No. 1 Funden Burk, in section 50.

COMPLETIONS ON TEXAS COAST

Completions of the week with pay sand record or total depth, and initial 24-hour production, follows:

Brazoria County

Danbury field: Tom Hunter No. 1 Blackley-Winson, abandoned. Hastings field: Humble Oil & Refining Co. No. 6 W. G. McDeed, 6,080 feet, 589 bbls., quarter-inch choke. Stanolind Oil & Gas Co. No. 6 C. H. Blount, 6,080 feet, perforated casing at 6,042-62 feet, 431 bbls., quarter-inch choke. Stanolind Oil & Gas Co. No. 24 Drake 5,502 feet, perforated casing 5,481-91 feet, 611 bbls., quarter-inch choke. Stanolind Oil & Gas Co. No. 1 C. W. Massey, 6,080 feet, perforated casing 6,034-72 feet, 639 bbls., quarter-inch choke. Stanolind Oil & Gas Co. No. 5 Pennock, 5,445 feet, perforated casing 5,370-97 feet, 597 bbls., quarter-inch choke. Stanolind Oil & Gas Co. No. 8 S. A. Pennock, 6,080 feet, perforated casing 6,042-75 feet, 581 bbls., quarter-inch choke. Manvel field: Sam E. Wilson No. 1 O. L. Rash, 6,003 feet, abandoned. Texas Co. No. 31 Houston Oil Field Asosciation, 5,680 feet, 574 bbls., quarter-inch choke. West Columbia field: Adrian Moore No. 1 Gulf fee, 5,390 feet, 344 bbls., 14 hours, one-quarter inch choke. Texas Co.-Sterling Oil & Refining Co. No. 6 Phillips, 5,700 feet, 302 bbls., quarter-inch choke.

Chambers County

Anahuac field: Humble Oil & Refining Co. No. 18 Johnson, 7,110 feet, 380 bbls., quarter-inch choke. Humble Oil & Refining Co. No. 22 Tyrell, oil sand 7,005-85 feet, 267 bbls., quarter-inch choke. Turtle Bay field: Stanolind Oil & Gas Co. No. 1 Susan Sherman heirs, 6,640 feet, abandoned.

Galveston County

Dickinson field: Frank Bennett, 8,096 feet, perforated casing 8,033-39 feet, 587 bbls., quarter-inch choke. Humble Oil & Refining Co. No. 1 R. B. Peters, 9,355 feet, abandoned. Pure Oil Co. No. 3 Sam Levine, 8,119 feet, 570 bbls., quarter-inch choke. Stanolind Oil & Gas Co. No. 4 Daminani, 8,740 feet, perforated casing 8,112-22 feet, 638 bbls., quarter-inch choke.

Hardin County

Silsbee field: Republic Production Co.-Houston Oil Co. No. 2 Ellery fee, oil sand 6,963-67, 443 bbls., quarter-inch choke.

Jefferson County

Spindletop field: Stanolind Oil & Gas Co. No. 148 McFaddin, 2,971 feet, 75 bbls., 12 hours, quarter-inch choke.

Liberty County

Hardin field: Jack Frazier No. 2 B. F. Hanchey, 7,632 feet, plugged back 7,631 feet, perforated casing 7,616-31 feet, 536 bbls., quarter-inch choke. Gulf Oil Corp. No. 2 V. B. Hinson, 7,631 feet, perforated casing 7,620-30 feet, 558 bbls., quarter-inch choke.

Harris County

Friendswood field: Humble Oil & Refining Co. No. 1 Durwood, oil sand 5,763-6,042 feet, 61 bbls., quarter-inch choke. Humble Oil & Refining Co. No. 1-B J. L. Jones, oil sand 5,857-6,041 feet, 616 bbls., quarter-inch choke. Humble Oil & Refining Co. No. 1 N. G. Kildahl, oil sand 6,050-65 feet, 517 bbls., quarter-inch choke. Tomball field: Humble Oil & Refining Co. No. 1 Bishop, sand 5,551-71 feet, 528 bbls., quarter-inch choke. Shell Petroleum Corp. No. 1 W. E. Bennett, sand 5,552-66 feet, 421 bbls., quarter-inch choke.

Matagorda County

Markham field: Harrison-Abercrombie No. 1-B. C. T. Kountze, 4,373 feet, abandoned.

Tyler County

Spurger field: Republic Production Co.-Houston Oil Co. No. 7 Hurd, sand 7,665-7,110 feet, 631 bbls., quarter-inch choke.

Wharton County

Five Corners field: Texas Co. No. 13-B Pierce Estate, 5,549 feet, 194 bbls., 16 hours, 12/64-inch choke. Magnet field: Humble Oil & Refining Co. No. 6 H. C. Cockburn, 5,541 feet, perforated casing 5,528-32 feet, 127 bbls., one-eighth inch choke.

Central West Fields

(Continued from Page 252)

2,980-83 feet. The well flowed 410 bbls. in six hours, but was not yet completed.

In the same county, Pure Oil Co. No. 8 Palmer-Taylor, NW NE SE section 5-3n-9e, was also a near completion. Ste. Genevieve lime was topped at 2,987 feet and Roseclaire at 2,914 feet and pay was found at 2,940-46 feet and 2,965-67½ feet. Six-inch casing was set at 2,930 feet and the crew was running tubing.

Pure Oil Co. No. 3 Frost, C W half NW SW section 9-3n-9e, was drilling at 2,920 feet. American National Drilling Co. was drilling at 400 feet in No. 1 Everson, NE NE SE section 23-3n-9e.

In Saline County, C. F. Bolton No. 1 Beagle, NW cor. NE section 13-9s-7e, was shot with 160 quarts of nitroglycerin at 1,834-66 feet. The crew was ready to run liner with a packer at 1,815 feet, and clean out the hole.

In Wabash County, Martin and others No. 1 Wood, NE SE SW section 31-1n-12w (measuring from the Indiana central meridian), was drilling at 2,222 feet.

In Washington County, Bitterman and others were drilling at 617 feet in No. 1 Jesse, C SE NE section 16-3s-2w.

In Wayne County, Kenova Petroleum Corp. No. 1 Bright, NE NE NE section 21-1n-5e, was drilling at 2,229 feet. Texas Co. No. 1 Silverman, C E half SE NE section 15-3s-7e, was shut down, awaiting a pipe line; No. 2 Silverman, C E half SE SW section 16-3s-7e, was drilling at 1,578 feet.

OHIO

FINDLAY, Ohio, Feb. 21.—The central and southern Ohio fields yielded 10 gas wells, four dry holes and one oil well during the past week.

In Athens County, Rome Township, Gibson No. 1 P. W. Grosvenor, section 30, made 150,000 feet of gas from the second Cow Run sand at 760-64 feet; 50,000 feet of gas from the Stray sand at 810-14 feet and 834,000 feet of gas from the Maxon at 1,000-26 feet. In York Township, Kachelmacher Estate No. 2 C. H. Franks, section 10, was drilled to 934 feet and abandoned.

In Guernsey County, Millwood Township, Ohio Fuel Gas Co. No. 1 Thomas Hartley, section 9, is good for 40,000 feet of gas per day from the Berea at 1,510-20 feet. In Washington Township, Jones & Jewell No. 1 S. A. Smith, section 8, is a gas well making 617,000 feet per day from the Berea sand at 1,393-94 feet.

In Lawrence County, Washington Township, Portage Producers, Inc., No. 3 Cambria Clay Products Co., section 12, made 1,700,000 feet of gas from the Clinton at 2,986-3,008 feet.

In Licking County, Perry Township, Vandergrift Oil Co. No. 4 Beulay Weigle, section 16, is a 6-bbl. pumper from the Berea sand at 751-63 feet.

In Lorain County, Ridgeville Township, William Dempsey No. 1 George Myers, Sectional Lot 42, made 700,000 feet of gas from the Clinton at 2,381-99 feet.

In Meigs County, Salisbury Township, Bowman & Deem No. 2 Harriett Musser, section 34, made 340,000 feet of gas from 1,043-70 feet.

In Monroe County, Washington Township, H. B. Walker No. 2 George T. Adams, section 5, was abandoned at 1,417 feet.

In Muskingum County, Jackson Township, Wehrle Gas Co. No. 1 Oscar Mikesell, section 6, is a gas well making 47,000 feet per day from the Clinton at 3,165-96 feet. In Washington Township, Ohio Fuel Gas Co. No. 1 E. G. Melvin, fourth quarter, was drilled to 3,991 feet and abandoned.

In Stark County, Lawrence Township, Ohio Insulator Co. No. 1 Jacob Whitmyer, section 2, made 260,000 feet of gas per day from the Clinton sand at 3,978-88 feet.

In Summit County, Franklin Township, Reed and others No. 1 J. D. Crawfis, section 19, found the Clinton sand broken and dry. Total depth was 4,015 feet.

In Tuscarawas County, Sandy Township, East Ohio Gas Co. No. 1 Samuel Duerr, Lot 51, third quarter, is good for 1,700,000 feet of gas per day from the Clinton sand at 4,763-93 feet.

In Washington County, Ludlow Township, Hope Construction & Refining Co. No. 1 Laura Graham, section 14, made a 100,000-foot gasser from the Berea at 1,827-33 feet.

Lima Field

In Seneca County, Clinton Township, Tiffin Co. No. 2 Herman Clouse, NW quarter section 7, is now drilling at 2,029 feet, and expects to hit the St. Peter sand within the next week. The top of the Trenton was at 1,485 feet, with a show of gas 30 feet in. No oil showings have yet been found.

In Huron County, Hartland Township, Patterson and others No. 1 William Smith, Lot 7, section 3, was abandoned at 525 feet.

WESTERN KENTUCKY

OWENSBORO, Ky., Feb. 21.—A 100-bbl. well from Barlow sand in the Friendship Church district in Ohio County, was the best completion of the week in the Western Kentucky fields.

In Breckenridge County, Glen Dean district, Bryant & Moorman No. 3 Marcus Whittier was moving in. In the Cloverport district, Flesher, Galey and others No. 4 Murray Tile Co., a deep test, was drilling at 882 feet. It found a 70,000-foot production of gas at 880-82 feet.

In Daviess County, Pellville district, H. Grimes and others No. 8 Louis Petrie made 1 bbl. from Jett sand at 519½-34½ feet after a shot of 60 quarts.

In McLean County, Semiway district, Hume, Steele & Earley No. 1 Robert Nall was rigging up. In the Island district, South Penn Oil Co. No. 4 H. K. and John Kirtley found Jett sand at 1,403-19 feet, but was drilling ahead.

In Hancock County, Easton district, J. C. Ellis No. 1 W. C. Smith was rigging up. In the Pellville dis-

Interesting three-well hookup in the East Texas field, but so arranged and balanced that only two wells can be operated at one time. The choice of two of the three wells to be pumped is optional. Pitman from unit was disengaged at time picture was taken

trict, C. D. Walker and others No. 6 Elmer Boling was a dry hole. In the Goering district, Cumberland Petroleum Co. No. 3 Lambert & Morris was dry at a total depth of 650 feet. Jackson sand at 625-40 feet contained only water.

In Muhlenberg County, Bremen district, Peerless Oil Co. No. 1 C. C. Gossett, deep test, was rigging up. In the Greenville district, J. C. Ellis No. 4 R. O. Kennedy was a 3-bbl. well from McClosky sand at 1,634-55 feet. It may be acidized.

In Ohio County, Fordsville district, Cumberland Petroleum Co. and others No. 1, joint line deep test, was drilling at 1,040 feet. In the Friendship Church district, A. Teller and others No. 12 A. A. Whitehouse made 100 bbls. of oil initially from Barlow sand at 618-33 feet which had been shot with 40 quarts at 618-27 feet. Work on No. 13 was started. In the Lyonia district, H. A. Henry No. 5 Nora Chambers, an old well, drilled deeper to Jackson sand at 650-60 feet, was dry and plugged.

EASTERN KENTUCKY

ASHLAND, Ky., Feb. 21.—One gas well completion summed up the unusually light report from the Eastern Kentucky fields. This well was Kentucky-West Virginia Gas Co. No. 5 J. I. Stepp farm, on Levisa Fork, Floyd County. It reached a total depth of 2,490 feet, in White shale, and made an initial production of 165,000 feet of gas.

Other operations in Floyd County are as follows: The Kentucky-West Virginia Gas Co. is idle at No. 567, on the Slone land, on Levisa Fork. Same company's No. 568, on the Samuel Dillon land, on Ivy Creek of Levisa Fork, is down 90 feet in sand, and is drilling at 758 feet in No. 5233, on the John F. Burchett land, on Cow Creek. The Inland Gas Corp. has reached 3,098 feet in No. 197, on the J. C. Hopkins farm, on Stratton Branch of Levisa Fork, with drilling continuing in brown shale.

In Martin County, Kentucky-West Virginia Gas Co. is still cleaning out No. 5232, on the C. W. Preece land, on Coldwater Fork; is setting machine at No. 5236, and is grading location for No. 5237, all on the Preece land. The same firm is moving to location on the M. M. Pratt land.

In Pike County, Inland Gas Corp. is drilling at 3,098 feet in No. 197, on the Helen Leslie farm, Levisa Fork.

Powell County

Wireman Brothers are drilling below 500 feet in No. 3, on the Albert Stewart land, on South Fork, in the district of that name, in Powell County. South Penn Oil Co. is drilling at 450 feet in No. 10 on the Adams & Lamberson land on South Fork. Raymond Smythe No. 9, on the H. E. Stewart farm, at Fitchburg, was drilling at 200 feet.

A gas well, with a daily production estimated at 500,000 feet, was drilled in Thursday in Carter County. The well was put down by McCool & O'Brien and others, of Washington, Pa., on the Bennett heirs land on the Mill Branch Road near Nigger Gallows Gap. It was completed at a total depth of 516 feet, in Big Injun sand.

West Texas Fields

(Continued from Page 262)

705 bbls. Gibson Oil Corp. No. 3 Combs-Worley B, 2,830-2,970 feet, 210 bbls.

Carson County

Magnolia Petroleum Co. No. 34 fee, 2,948-3,154 feet, 232 bbls.; No. 35 fee, 2,935-3,000 feet, 117 bbls.

Hutchinson County

Watchorn No. 1 Whittenburg E, 2,630-56 feet, 287 bbls. Crane-Rankin No. 1 Barnhill, junked hole. Drilling & Exploration Co. No. 4 Pound, 3,045-72 feet, 577 bbls.; No. 14 Watkins, 2,915-2,944 feet, 515 bbls. Smith Brothers No. 1 Herring, 3,115-80 feet, 401 bbls.

Wheeler County

Hugal Oil Co. No. 7 Brinkley, dry and abandoned at depth of 2,445 feet. North Fork Oil Co. No. 5 Jackson, dry and abandoned at depth of 2,282 feet.

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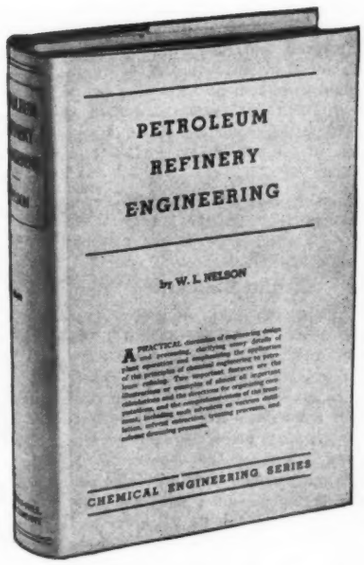

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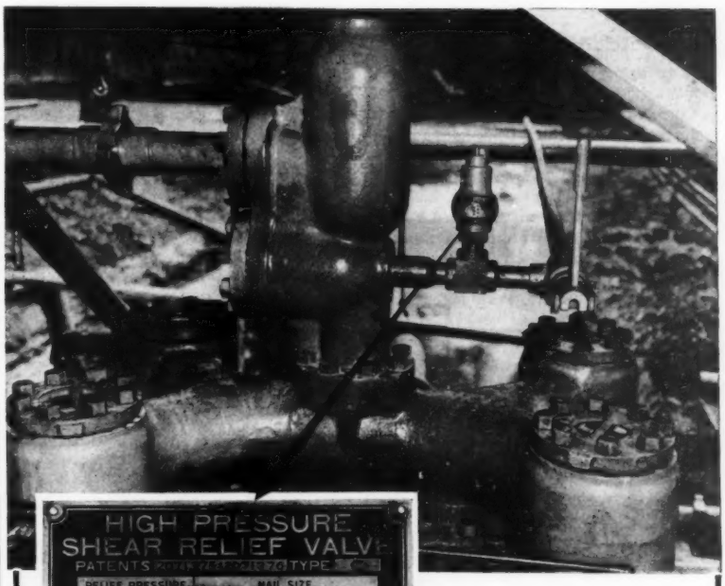

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Canadian Fields

Completions and Operations in Northwest and in Ontario

By VICTOR LAURISTON

CHATHAM, Ontario, Feb. 19.—Official figures show a total crude production from all Canadian fields in 1937 of 2,995,025 bbls.

Comparative figures for the various provinces are as follows:

	1936 (bbls.)	1937 (bbls.)
New Brunswick	16,595	22,549
Ontario	165,495	164,197
Alberta	1,320,442	2,796,908
N.W. Territories ...	5,399	11,371

Natural gas production in Canada for 1937 totaled 27,918,530,000 feet and in 1936 28,113,348,000 feet.

Acidizing Operations

Acidizing of crude wells on the west flank is being continued. Brown Oil Corp. No. 1, LSD 14, section 16-18-2w5, increased its potential from 1,597 to 1,849 bbls., prorated at 777 bbls. Brown No. 2, LSD 8, section 20-18-2w5, increased from 628 to 1,006 bbls., prorated at 422 bbls. Four Star Petroleums No. 1, LSD 13, section 28-18-2w5, with previous potential of 609 bbls., increased to around 1,000 bbls. Prairie Royalties No. 1, LSD 16, section 17-18-2w5, with potential of 1,275 bbls., was increased to over 1,500 bbls.

Royal Canadian Oils No. 1, LSD 15, section 20-18-2w5, increased its potential by acidizing from 920 to 964 bbls., and will likely be given a second treatment.

Tests in the Lime

Temperatures ranging down to 35 below zero and heavy snow have delayed completion of Turner Valley west flank tests now drilling in the lime. Richland Royalties No. 2, LSD 5, section 28-18-2w5, is finishing with cable tools below 6,855 feet, more than 445 feet in the Madison, with the black lime expected at 6,885 feet, where drilling will be halted for a production test. The well is spraying oil over the derrick and has a strong gas flow. With the main porous horizon still to be drilled, a potential of around 500 bbls. was estimated; and a large producer is expected.

In section 20-18-2w5, Spy Hill Royalties No. 1, LSD 16, is below 6,996 feet, 393 feet in the Madison limestone, and will probably be completed this month.

In section 32-18-2w5, Royalite Oil Co. No. 28, LSD 16, is below 6,727 feet, after getting the limestone at 6,429 feet.

West Side Drilling

On the west flank of the West Central Turner Valley area, Vulcan Brown Petroleums, LSD 10, section 5-19-2w5, is cementing casing at 4,193 feet.

In section 32-18-2w5, Royalite Oil Co. No. 30, LSD 11, is below 2,907 feet. West Turner Petroleums No. 1, LSD 2, is below 5,800 feet, and is expected to get the Madison limestone this month. West Turner No. 2, LSD 7, is below 1,062 feet.

In section 29-18-2w5, Globe Royalties No. 1, LSD 7, is below 3,308 feet. Davies Petroleums No. 1, LSD 2, is below 6,433 feet after getting the Home sand at 6,396 feet. The test is logging 100 feet higher than Commoil No. 1, and is expected to get the limestone around 6,800 feet. Sunburst Oil Co. No. 1, N half same LSD, is below 6,290 feet, after getting the Home sand at 6,205 feet. The Dalhousie formation is expected at 6,305 feet.

In section 20-18-2w5, Consolidated Royalties No. 1, LSD 14, has spudded, and is below 150 feet. It is west of Royal Canadian Oils No. 1 producer. Intercity Royalties No. 1, LSD 11, offsetting Sunset Oils No. 1 producer to the west, is below 307 feet. Sunset Oils No. 2, LSD 7, same section, has derrick foundations ready and is moving rotary outfit from Brown Oil Corp. No. 3. United-Brown Petroleums No. 5, LSD 1, is deepening after drilling out cement at 3,047 feet. York Oils No. 1, LSD 2, is below 1,842 feet.

In section 16-18-2w5, Frontier Royalties No. 1, LSD 11, is below 2,190 feet. Drilling of this test, offsetting Brown Oil Corp. No. 1 producer to the south, is being financed and handled by Drilling Contractors, Ltd., subsidiary of the Anglo-Canadian Development & Holding Co. of Calgary. Okalta Oil Co. No. 7, LSD 3, is resuming after cementing 18⅝-inch casing at 250 feet. Okalta No. 8, LSD 6, is spudding.

In section 9-18-2w5, National Petroleum Corp. No. 2, LSD 14, is below 4,944 feet and getting close to the cardium sandstone marker.

Okalta Structure

On the Okalta fold, west of Turner Valley, Okalta Oil Co. No. 6, LSD 3, section 30-18-2w5, has resumed from 3,805 feet after installing a heavy-duty rotary outfit capable of drilling to 11,000 feet. Scottish Petroleums No. 1, LSD 16, section 19-18-2w5, is below 680 feet.

Farther north, Mission Oil Co. No. 1, LSD 16, section 31-18-2w5, is digging cellar and laying gas lines from the west flank wells in section 32. Location is a mile or more west of the nearest crude producer. The test is being sponsored jointly by the Anglo-Canadian Development & Holding Co. with one-third interest and the Prairie, Firestone, Monarch and Foundation producing companies with one-sixth interest each.

North Turner Valley

In North Turner Valley, Royalite Oil Co. No. 29 Turner Basin, LSD 7, section 27-20-3w5, is below 6,490 feet after getting the Madison limestone at 6,275 feet.

East Side Drilling

On the Aldersyde structure, east of Turner Valley, Ranchmen's Gas & Oil Co. No. 1, LSD 16, section 13-20-29w4, will be completed by the Anglo-Canadian Development & Holding Co. of Calgary. Reorganization of the Ranchmen's Gas & Oil Co. has been completed by formation of a new company, Ranchmen's Oil Co., Ltd., which takes over the assets and assumes the liabilities of the former. The reorganization does not affect creditors or royalty holders of the old company, while shareholders will receive 11 new for 10 old shares. Edward Kenney, associated with the original company since its inception, is president of Ranchmen's Oil Co.

Drilling has been resumed with W. F. Farris in charge, under joint supervision of Ralph Will, drilling superintendent of the Anglo-Canadian company, and Mr. Kenney. The well is in the Dalhousie sands at 7,230 feet and fishing for lost tools. There is a prospect of commercial production in the Dalhousie, and the Madison limestone is expected around 7,350 feet. If production is not found in the Dalhousie, rotary outfit will be installed to test the Madison.

On the Calling Valley structure, Sentinel Oil Co. No. 1, LSD 1, section 8-20-2w5, is shut down at 6,750 feet owing to bad weather.

Brownsville Gassers

In the Brownsville field, Oxford County, Ontario, Adams - McCutcheon - Aikens No. 1, NW quarter Lot 27, Concession 12, Dereham Township, finished around 935 feet with 1,090,000 feet a day. Aloka Oil & Gas Co. No. 2, Louis Brown farm, Lot 26, Concession 12, finished in the same horizon with 4,300,000 feet a day. A total of 60 producing gassers has now been drilled in the Brownsville field.

A brochure on "Carbon Dioxide in New Mexico" by Dr. E. H. Wells and A. Andreas, reprinted from the New Mexico School of Mines "Gold Pan" has just been issued. Copies may be obtained gratis from the New Mexico Bureau of Mines and Mineral Resources, School of Mines, Socorro, N. M.

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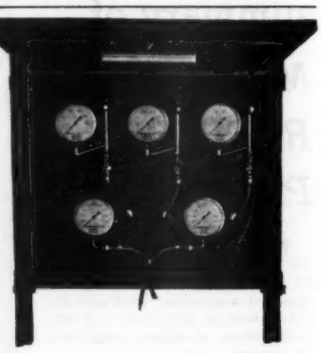

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CALIFORNIA

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Company, well, location, and county—	S.T.R.	Depth	Status
Wilshire Oil, No. 1 Gaviota, Santa Barbara	35- 5-33	1,971	sd. sh. drlg.
Hancock-Bush, No. 2-W Santa Maria, Santa Barbara	30-10-33	3,841	sd. sh. drlg.
Hancock-Bush, No. 2-R Santa Maria, Santa Barbara	25-10-34	3,951	sd. sh. drlg.
Anderson, Joseph, No. 1 A.&T. S. Maria, S. Barbara	28-10-34	4,891	sd. sh. drlg.
Cal. Lands, Inc., No. 3 Santa Maria, Santa Barbara	26-10-34	3,243	sd. sh. drlg.
Moore, E. H., No. 13-E Sugar, S. Maria, S. Barbara	24-10-35	5,527	sd. sh. drlg.
Signal Oil, No. 2 Romalho, S. Maria, Santa Barbara	27-10-34	4,580	sd. sh. drlg.
Union Oil, No. 2-V Santa Maria, Santa Barbara	21-10-34	2,990	sd. sh. drlg.
Union Oil, No. 2-0, Santa Maria, Santa Barbara	20-10-34	1,977	sd. sh. drlg.
Union Oil, No. 1 Wheat, Santa Maria, Santa Barbara	22-10-34	4,181	sd. sh. drlg.
Union Oil, No. 20 Squires, Orcutt, Santa Barbara	27- 9-34	4,096	O. S. drlg.
Pet. Equities, No. 15 Santa Maria, Santa Barbara	27-10-34	1,774	sd. sh. drlg.
York Oil, No. 2 Doane, Santa Maria, Santa Barbara	27-10-34	2,146	sd. sh. drlg.
Jones, F. E., No. 1-W, Santa Maria, Santa Barbara	27-10-34	4,600	sd. sh. drlg.
Pac. West Oil, No. 11-H Santa Maria, Santa Barbara	21-10-34	2,996	sd. sh. drlg.
Pac. West Oil, No. 3-D, Santa Maria, Santa Barbara	27-10-34	4,198	pump 820 b.d
Pima Drlg., No. 1 Morganti, Casmalia, Santa Barbara	13- 9-35	1,800	bailing
Standard Oil, No. 1 Cat Canyon, Santa Barbara	27- 9-33	4,893	hd. sh. drlg.
Bell, A. E., No. 4 York, Lompoc, Santa Barbara	33- 8-34	3,035	sd. sh. drlg.
Moyle Pet., No. 1 Gato Ridge, Santa Barbara	9- 8-32	3,270	redrlg. 3,198
Carpinteria Oil, No. 1 Carpinteria, Santa Barbara	32- 4-25	340	sd. sh. drlg.
Fisher, D. No. 1 Cuyama, Santa Barbara	28-11-28	958	hd. sh. drlg.
Rowe, W. G., No. 1 Johnson, Oxnard, Ventura	15- 1-22	3,440	gr. sd. drlg.
High Mesa Oil Co., No. 1 Butcher, Ojai, Ventura	16- 4-22	1,325	hd. sd. drlg.
Texas Co., No. 5 Yale, South Mountain, Ventura	13- 3-21	2,381	sd. sh. drlg.
Texas Co., No. 1 Edwards, Camarillo, Ventura	19- 2-21	6,111	fish D.P.
Stalling & Senter, No. 1 Timber Canyon, Ventura	24- 4-21	680	O.S. drlg.
Arnett, F. E., No. 3 Santa Paula, Ventura	15- 4-21	1,401	sd. sh. drlg.
Section 20 Oil, No. 1 Sespe, Ventura	20- 5-19	1,607	reaming
Garmack Oil, No. 1 Orcutt, Sespe, Ventura	28- 5-19	503	idle
Condor Oil, No. 1 Dorman, Sespe, Ventura	6- 4-19	2,193	idle
Skyline Oil, No. 1-H Hopper Canyon, Ventura	13- 4-19	2,771	pump, test
Continental Oil, No. 8-A Grubb, S. Miguelito, Ventura	24- 3-24	6,700	flow 130 b.d.
C. C. M. Oil, No. 11 Rincon, Ventura	17- 3-24	3,760	cleaning out
C. C. M. Oil Co., No. 19 Rincon, Ventura	17- 3-24	1,977	redrlg. 810
C. C. M. Oil, No. 20 Rincon, Ventura	8- 3-24	3,672	sd. sh. drlg.
Richfield Oil, No. 1 State, Rincon, Ventura	17- 3-24	2,580	recmtd. 2,553
General Pet., No. 3 Ferguson, Rincon, Ventura	6- 3-24	2,610	cleaning out
Tide Water A.O., No. 19 V.L.W., Ventura, Ventura Co.	26- 3-23	6,172	sd. sh. drlg.
Tide Water A.O. No. 41 V.L.W., Ventura, Ventura	24- 3-23	6,597	sd. sh. drlg.
Tide Water A.O., No. 69 Lloyd, Ventura, Ventura	27- 3-23	6,352	sd. sh. drlg.
Tide Water A.O., No. 79 Lloyd, Ventura, Ventura	27- 3-23	4,990	sd. sh. drlg.
Tide Water A.O., No. 135 Lloyd, Ventura, Ventura	27- 3-23	9,478	hd. sh. drlg.
Tide Water A.O., No. 138 Lloyd, Ventura, Ventura	23- 3-23	8,580	hd. sh. drlg.
Tide Water A.O., No. 18 Hartman, Ventura, Ventura	2- 3-23	10,093	O.S. drlg.
Shell Oil, No. 93 Taylor, Ventura Ave., Ventura	30- 3-23	7,250	O.S. drlg.
General Pet., No. 13 Notten, Ventura Ave., Ventura	28- 3-33	9,781	cleaning out
Amerada Pet., No. 5 Beer, Devils Den, Kern	22-26-19	6,717	cleaning out
Gibson Oil, No. 3 Alferitz, Devils Den, Kern	14-25-18	198	idle
Rocima Oil, No. 1 Laymance, McKittrick, Kern	20-30-22	3,122	P.B. 1,427
Par-Mer Oil, No. 1 McKittrick, Kern	6-31-30	2,064	cleaning out
Standard Oil, No. 2 Randolph, Semi-Tropic, Kern	14-27-23	9,573	gr. sh. drlg.
Continental Oil, No. 2 KCL, Wasco, Kern	8-27-24	13,315	hd. sh. drlg.
Chico-Martinez Oil, No. 1 South Belridge, Kern	1-29-20	1,066	P.B. 1,050
Taylor, W. No. 1 FKL, South Belridge, Kern	12-29-21	743	sd. sh. drlg.
Texas Co., No. 2-23 Theta, Lost Hills, Kern	2-26-20	1,255	P.B. 1,234
Argo Pet., No. 1 Farnsworth, Lost Hills, Kern	11-26-20	691	sd. sh. drlg.
Belridge Oil, No. 27-7 North Belridge, Kern	27-27-20	797	br. sh. drlg.
Belridge Oil, No. 27-8 North Belridge, Kern	27-27-20	8,055	cmtd. 8,050
Belridge Oil, No. 27-61 North Belridge, Kern	27-27-20	8,750	flow 120 b.d.
Tide Water A.O., No. 7 Reward, North Belridge, Kern	34-27-20	8,196	br. sh. drlg.
Tide Water A.O., No. 1-21 North Belridge, Kern	21-27-20	8,107	sd. sh. drlg.
Tide Water A.O., No. 2-21 North Belridge, Kern	21-27-20	8,132	br. sh. drlg.
Richfield Oil, No. 1-A North Belridge, Kern	22-27-20	7,170	br. sh. drlg.
Texas Co., No. 2 Martin, North Belridge, Kern	22-27-20	8,170	O.S. drlg.
Texas Co., No. 3 Martin, North Belridge, Kern	22-27-20	5,691	br. sh. drlg.
General Pet., No. 1 St. Helens, Belridge, Kern	12-28-20	7,550	br. sh. drlg.
Johnson, G. W. No. 1 Brown, Temblor, Kern	33-29-20	1,015	cleaning out
Richfield Oil, No. 1 Olcese, Round Mountain, Kern	17-28-29	1,591	redrlg. 1,272
Shell Oil, No. 18 Caldwell, Round Mountain, Kern	7-28-29	1,954	pump 180 b.d.
Coast Expl., No. 1 Coffee, Round Mountain, Kern	6-28-29	1,915	sd. sh. drlg.
Vedder Pet., No. 1 Bell, Round Mountain, Kern	12-28-28	1,745	pump 340 b.d.
Vedder Pet., No. 2 Bell, Round Mountain, Kern	12-28-28	901	sd. sh. drlg.
Rubenstein, A.B., No. 1 Lerdo, Kern	20-28-27	3,352	bailing
Dickey, H.B., No. 1 Kern River, Kern	34-28-28	480	sd. sh. drlg.
Pottenger, F.M., No. 1 Orcier, Mount Poso, Kern	34-25-28	697	sd. sh. drlg.
Carter, J.P., No 2 S.P.L., Mount Poso, Kern	3-27-28	1,473	cleaning out
Bargol Oil, No. 2 Claflin, Mount Poso, Kern	10-27-27	916	sd. sh. drlg.
Ring Oil, No. 2 Jones, Mount Poso, Kern	29-26-28	1,753	pump 270 b.d
Ring Oil, No. 1 KCL, Mount Poso, Kern	16-26-28	1,098	sd. sh. drlg.
Western Gulf Oil, No. 33 KCL, Fruitvale, Kern	14-29-27	2,793	sd. sh. drlg.
Cal-West. Oil, No. 1 KCL, Fruitvale, Kern	14-29-27	3,551	P.B. 3,511
Wood Callahan Oil, No. 21-2 Edison, Kern	21-30-29	3,000	sd. sh. drlg.
Texas Co., No. 1 Bastain, Mountain View, Kern	34-30-29	4,641	dry; abd.
Petrex, Inc. No. 1 Arvin, Kern	32-31-30	3,140	cleaning out
Superior Oil, No. 1 Wagner, Rio Bravo, Kern	35-28-25	10,580	br. sh. drlg.
Superior Oil, No. 2 Wagner, Rio Bravo, Kern	35-28-25	6,493	sd. sh. drlg.
Superior Oil, No. 1 Geissinger, Rio Bravo, Kern	32-28-25	9,377	sd. sh. drlg.
Superior Oil, No. 1 Ruhl, Rio Bravo, Kern	1-29-25	8,716	sd. sh. drlg.
Union Oil, No. 2-34 KCL, Rio Bravo, Kern	34-28-25	9,946	sd. sh. drlg.
Getty Oil, No. 1 Ramsey, Rio Bravo, Kern	35-28-25	5,864	sd. sh. drlg.
General Pet., No. 1 Wagoner, Rio Bravo, Kern	35-28-25	5,871	sd. sh. drlg.
Shell Oil, No. 58-A KCL, Bellevue, Kern	29-29-27	4,620	sd. sh. drlg.
Continental Oil, No. 1-D KCL, Greeley, Kern	10-30-26	5,956	sd. sh. drlg.
Superior Oil, No. 9 KCL, Greeley, Kern	3-30-26	7,870	redrlg. 5,182
Standard Oil, No. 1 Calder Klassen, Greeley, Kern	20-29-26	7,781	sd. sh. drlg.
Standard Oil, No. 2 Fleishauer, Greeley, Kern	20-29-26	6,574	sd. sh. drlg.
Standard Oil, No. 11-2 KCL, Greeley, Kern	20-29-26	9,970	sd. sh. drlg.
Standard Oil, No. 11-12 KCL, Greeley, Kern	20-29-26	7,902	redrlg. 6,750
Standard Oil, No. 11-13 KCL, Greeley, Kern	20-29-26	4,786	sd. sh. drlg.
Standard Oil, No. 12-4 KCL, Greeley, Kern	16-29-26	7,386	gr. sh. drlg.
Shell Oil, No. 8-29-A KCL, Ten Section, Kern	29-30-26	6,740	sd. sh. drlg.
Shell Oil, No. 85-25-B KCL, Ten Section, Kern	25-30-26	8,220	flow 226 b.d.
Shell Oil, No. 41-32-B KCL, Ten Section, Kern	32-30-26	7,280	sd. sh. drlg.
Shell Oil, No. 52-31-B KCL, Ten Section, Kern	31-30-26	8,119	O.S. drlg.
Shell Oil, 81-31-B KCL, Ten Section, Kern	31-30-26	3,352	sd. sh. drlg.
Shell Oil, No. 72-14-A KCL, Canal, Kern	14-30-25	8,150	O.S. drlg.
Ohio Oil, No. 4-E KCL, Canal, Kern	13-30-25	8,177	flow 2180 b.d.
Ohio Oil, No. 8-A KCL, Buena Vista Lake, Kern	32-31-26	7,784	sd. sh. drlg.
Merritt-Annex Oil, No. 7 Midway-Sunset, Kern	25-12-24	3,420	hd. sd. drlg.
Richfield Oil, No. 1 M.C. Midway-Sunset, Kern	24-31-22	2,560	sd. sh. drlg.
C. C. M. Oil, No. 76 M.S., Midway-Sunset, Kern	6-32-23	1,315	deepening
Berry Oil, No. 22 Midway-Sunset, Kern	28-12-24	398	sd. sh. drlg.
Chemeketa Oil, No. 1 Midway-Sunset, Kern	15-32-23	2,355	bailing
Standard Oil, No. 35-23-D Midway-Sunset, Kern	23-32-24	3,276	sd. sh. drlg.
Victor Oil, No. 14 Midway-Sunset, Kern	35-32-23	2,730	gr. sd. drlg.
Formax Oil, No. 22 Midway-Sunset, Kern	36-32-23	1,293	sd. sh. drlg.
National Oil, No. 17 Midway-Sunset, Kern	35-32-23	1,299	sd. sh. drlg.
Texas Co., No. 1 Pioneer, Midway-Sunset, Kern	33-11-23	6,951	gr. sd. drlg.
Texas Co., No. 30 Midway-Sunset, Kern	32-32-24	3,245	fish, bailer
Standard Oil, No. 2-14-A Tupman, Elk Hills, Kern	36-30-24	2,995	rig to pump
Petrol Corp., No. 1 Tejon, Kern	32-11-19	5,560	br. sh. drlg.
Honolulu Oil, No. 33-1 SP, Tejon, Kern	33-12-19	8,030	sd. sh. drlg.
Universal Cons'd No. 1 Tejon, Kern	33-11-19	4,988	P.B. 4,634
Shell Oil, No. 4-26 KCL, San Emidio, Kern	26-11-22	7,596	sd. sh. drlg.
Pure Oil, No. 1 Cantua, Fresno	31-18-18	10,415	milling
Superior Oil, No. 1 C.U.P., Fresno	20-16-13	4,190	sd. sh. drlg.
Dauphin Dev., No. 1 Alcade, Fresno	30-21-14	3,778	rg blew down
Jacalitos Oil, No. 1 Jacalitos, Fresno	14-21-15	5,870	redrlg. 4,820
Pet. Sec., No. 2 Gatchell, Jacalitos, Fresno	18-20-16	5,518	gr. sh. drlg.
Central Valley Oil, No. 1 Joaquin, Fresno	1-12-20	536	gr. sd. drlg.
K.N.D.A., No. 4-18-J Kettleman North, Fresno	18-21-17	10,810	tested wet
K.N.D.A., No. 67-20-J Kettleman North, Fresno	20-21-17	9,358	sd. sh. drlg.
K.N.D.A., No. 72-4-P Kettleman North, Fresno	4-22-17	7,463	br. sh. drlg.

KEY TO ABBREVIATIONS USED IN DRILLING REPORTS

Abd., abandoned.
Acd., acidized.
B.O., barrels of oil.
B.P.D., barrels per day.
B.D., barrels daily.
B.P., back pressure.
B.R., building rig.
Br. sh., brown shale.
B.S., basic sediment.
Cd. or Crd., cored.
C.D., corrected depth.
Cg., coring.
Cmtd., cemented.
C.O., cleaning out.
Comp., completed.
Compr., compressor.
C.P., casing pressure, also cement through perforations.
Csg., casing.
D.D., drilling (or drilled) deeper.
Drlg. or Drg., drilling.
Drk. or Dk., derrick.
D.S., drill stem.
D.&A., dry and abandoned.
Fsg., fishing.
Gbo., gumbo.
G.I., gas injection.
Gr., gravity.
Gr. sd., gray sand.
Grn. sh., green shale.
Hd. sd., hard sand.
H.F.W., hole full of water.
I.P., initial production.
L., lime.
L.D.D., later drilled deeper.
Lnr., liner.
Loc., location.
M.I.M., moving in material.
M.I.R., moving in rig.
M.I.R.T., moving in rotary tools.
M.O.T., milling on tools.
O.I.H., oil in hole.
O.S., oil sand.
O.T.D., old total depth.
O.W.D.D., old well drilling deeper.
O.W.P.B., old well plugging back.
P.B., plugging or plugged back.
P.B.P., pulling or pulled big pipe.
P.L., pipe line.
P.L.O., pipe line oil.
Pmpg., pumping.
P.O.P., putting on pump.
P.P., pulled pipe.
Rd. sd., red sand.
Rd. sh., red shale.
Recmt., recemented.
Rmg., reaming.
Redrlg., redrilling.
Rng., running.
R.O.G., rig on ground.
R.P., rock pressure.
R.U., rigging up.
R.U.R., rigging up rotary.
R.U.S.T., rigging up standard tools.
R.&T., rods and tubing.
S. or Sd., sand.
S.D., shut down.
Sdy. sh., sandy shale.
Sdtr., or St. sidetracking.
S.D.P.L., shut down for pipe line.
S.D.O., or S.D.W.O., shut down awaiting orders.
S.G., show gas.
Sh.&L., shale and lime.
S.I., shut in.
S.I.P., shut in, prorated.
S.L.M., steel line measurement.
S.O., show oil.
S.O.G.&W., show of oil, gas and water.
Spdg. or Spd., spudding.
S.R., straightreaming.
Stdg., standardizing (also standing).
S.W., salt water.
Swbg., swabbing.
T.A., temporarily abandoned.
Tbg., tubing.
T.D., total depth.
T.P., tubing pressure.
Tr., tract.
U.R., underreaming.
W.I.H., water in hole.
W.O., workover.
W.O.C. or W.O.C.S., waiting for cement to set.
W.P., working pressure.
W.S.O., water shutoff.
W.S.S.O.K., water shutoff O.K.
W.S.O.N.G., water shutoff no good.
W.S.R. or W.O.S.R., awaiting standard rig.
Wtr., water.

K.N.D.A., No. 6-6-Q Kettleman North, Kings	6-22-18	8,690	P.B. 8,189
K.N.D.A., No. 6-8-Q Kettleman North, Kings	8-22-18	5,571	sd. sh. drlg.
K.N.D.A., No. 38-8-Q Kettleman North, Kings	8-22-18	2,340	sd. sh. drlg.
K.N.D.A., No. 47-18-Q Kettleman North, Kings	18-22-18	5,080	sd. sh. drlg.
Standard Oil, No. 27-21-J Kettleman North, Fresno	21-21-17	10,100	hd. sd. drlg.
Standard Oil, No. 58-33-J Kettleman North, Fresno	33-21-17	5,452	sd. sh. drlg.
Standard Oil, No. 2-11-P Kettleman North, Kings	11-22-17	7,850	cleaning out
Standard Oil Co., No. 76-1-P Kettleman North, Kings	1-22-17	8,474	fl. 1,610 b.d.
Standard Oil, No. 87-1-P Kettleman North, Kings	1-22-17	4,980	sd. sh. drlg.
Standard Oil, No. 21-13-P Kettleman North, Kings	13-22-17	7,190	br. sh. drlg.
Standard Oil, No. 41-7-Q Kettleman North, Kings	7-22-18	6,598	br. sh. drlg.
Standard Oil, No. 85-7-Q Kettleman North, Kings	7-22-18	2,248	sd. sh. drlg.
Superior Oil, No. 5 Huffman, Kettleman N., Fresno	29-21-17	10,746	flow 600 b.d.
Bandini Pet., No. 5 Whepley, Kettleman N., Fresno	35-21-17	9,400	sd. sh. drlg.
Friend, C.C., No. 1 Tulare Lake, Kings	17-22-19	442	idle
Pyramid Prod., No. 1 Kettleman Plains, Kings	27-24-18	2,140	sd. sh. drlg.
Standard Oil, No. 2 Weyl, McDonald Isl., S. Joaquin	25- 2- 4	8,145	gr. sd. drlg.
Little Cuyama Oil, No. 1 Elkhorn, San Luis Obispo	4-10-26	1,502	dry; abd.
Wilshire Oil, No. 1 Cowell, Half Moon Bay, San Mateo	20- 6- 5	7,511	sd. sh. drlg.
Amerada Pet., No. 1 McCormick, Rio Vista, Solano	1- 3- 2	4,384	35,000 M.C.F.

IMPORTANT WELLS AND SOUTHERN CALIFORNIA WILDCATS

Company, well, location, and county—	S.T.R.	Depth	Status
Apex Pet., No. 1-C El Segundo, Los Angeles	12- 3-15	7,408	sd. sh. drlg.
Sovereign Oil, No. 1 El Segundo, Los Angeles	12- 3-15	5,440	sd. sh. drlg.
Termo Co., No. 2 El Segundo, Los Angeles	12- 3-15	7,240	sd. sh. drlg.
Ohio Oil, No. 11 Gough, El Segundo, Los Angeles	7- 3-14	7,140	sd. sh. drlg.
Texas Co., No. 6 Security, El Segundo, Los Angeles	18- 3-14	7,315	pmp. 102 b.d.
Standard Oil, No. 8 Refinery, El Segundo, L. Angeles	13- 3-15	7,160	sd. sh. drlg.
Wilshire Oil, No. 1 Const., El Segundo, Los Angeles	12- 3-15	7,215	sd. sh. drlg.
Union Oil, No. 16-D.R., Playa Del Rey, Los Angeles	28- 2-15	6,099	casing bad
Standard Oil, No. 84 LAI Inglewood, Los Angeles	17- 2-14	3,615	rig to pump
Phalen & Pietzschke, No. 1 Tor., Ingle., L. Angeles	14- 4-14	3,790	cleaning out
Pollock & O'Niel, No. 21 Torrance, Los Angeles Co.	14- 4-14	3,800	redrlg. 2,450
McCaslin, W. E., No. 2 Torrance, Los Angeles	14- 4-14	3,805	fish liner
Patton, C. B., No. 2 Torrance, Los Angeles	14- 4-14	5,017	pmp. 120 b.d.
Anderson, N. H., No. 2 Torrance, Los Angeles	14- 4-14	5,006	O.S. drlg.
Anderson N. H., No. 4 Torrance, Los Angeles	23- 4-14	5,051	sd. sh. drlg.
Emerald Oil, No. 1 Fee, Torrance, Los Angeles	23- 4-14	5,155	P.B. 5,125
Camp, C. W., No. 1 Perkins, Torrance, Los Angeles	23- 4-12	4,378	sd. sh. drlg.
Doyle Pet., No. 1 Bond, Torrance, Los Angeles	14- 4-14	3,041	sd. sh. drlg.
Doyle Pet., No. 1 Neill, Torrance, Los Angeles	14- 4-14	563	sd. sh. drlg.
Elyod Oil, No. 1 Post, Torrance, Los Angeles	14- 4-14	3,774	cleaning out
Woolner Oil Co., No. 5 Torrance, Los Angeles	14- 4-14	5,020	sd. sh. drlg.
Texas Co., No. 5 Redondo, Torrance, Los Angeles	5- 4-14	3,442	cleaning out
Texas Co., No. 3 Wilson, Torrance, Los Angeles	15- 4-14	3,759	cleaning out
M.&M. Oil, No. 6-L Torrance, Los Angeles	22- 4-12	4,995	sd. sh. drlg.
Albertson Oil, No. 1-P Torrance, Los Angeles	23- 4-14	5,120	pmp. 130 b.d.
Superior Oil, No. 5 Torrance, Los Angeles	16- 5-14	3,730	redrlg. 2,860
Lakeside Oil, No. 1 Cook, Torrance, Los Angeles	16- 4-14	3,760	will deepen
Coast Line Oil, No. 1 Torrance, Los Angeles	16- 4-14	3,775	fish liner
C.C.M.O., No. 14 Torrance, Los Angeles	16- 4-14	4,015	deepening
Torrance Pet., No. 2 Torrance, Los Angeles	14- 4-14	4,927	pmp. 118 b.d.
Fisher, N., No. 1 Watkins, Torrance, Los Angeles	23- 4-14	5,147	sd. sh. drlg.
Fisher N., No. 1 Washburn, Torrance, Los Angeles	16- 4-14	5,175	sd. sh. drlg.
Berken Oil, No. 1 Star, Torrance, Los Angeles	16- 4-14	3,758	will deepen
Rolling Hills Pet., No. 1 Palos Verdes, Los Angeles	27- 4-14	3,900	idle
Shell Oil, No. 93 Reyes, Dominguez, Los Angeles	33- 3-13	6,850	flow 320 b.d.
Union Oil, No. 49 Hellman, Dominguez, Los Angeles	33- 3-13	6,724	sd. sh. drlg.
Union Oil, No. 58 Callender, Dominguez, Los Angeles	33- 3-13	4,870	sd. sh. drlg.
Union Oil, No. 59 Callender, Dominguez, Los Angeles	33- 3-13	4,491	cmtd. 3,947
Union Oil, No. 60 Callender, Dominguez, Los Angeles	33- 3-13	1,163	sd. sh. drlg.
Barnsdall Oil, 19 O'Dea, Rosecrans, Los Angeles	18- 3-13	7,600	flw. 1,450 b.d.
Union Oil, No. 35 H.P., Rosecrans, Los Angeles	18- 3-13	4,970	pump 50 b.d.
Union Oil, No. 18-R Rosecrans, Los Angeles	18- 3-13	7,005	sd. sh. drlg.
Universal Cons'd, No. 2 rust, Rosecrans, Los Angeles	18- 3-13	3,980	sd. sh. drlg.
Texas Co., No. 5-1 Gardena, Los Angeles	30- 3-13	7,700	sd. sh. drlg.
Towsley Canyon Oil, No. 1 Newhall, Los Angeles	8- 3-16	4,105	cleaning out
Royal Lands, No. 1 Ramona, Castaic, Los Angeles	8- 4-17	366	idle
General Pet., No. 2 Blinn, Wilmington, Los Angeles	35- 5-13	2,945	sd. sh. drlg.
General Pet., No. 34 Ford, Wilmington, Los Angeles	4- 5-13	2,807	O.S. drlg.
General Pet., No. 37 Ford, Wilmington, Los Angeles	4- 5-13	3,607	O.S. drlg.
General Pet., No. 3-5-C.C., Wilmington, Los Angeles	2- 5-13	2,296	sd. sh. drlg.
General Pet., No. 1 Harbor, Wilmington, Los Angeles	3- 5-13	3,939	cleaning out
General Pet., No. 2 Harbor, Wilmington, Los Angeles	2- 5-13	2,992	flow 425 b.d.
General Pet., No. 5 Harbor, Wilmington, Los Angeles	2- 5-13	2,493	sd. sh. drlg.
General Pet., No. 7 Harbor, Wilmington, Los Angeles	2- 5-13	3,900	sd. sh. drlg.
Allied Pet., No. 24 Wilmington, Los Angeles	32- 4-13	2,921	O.S. drlg.
Bankline Oil, No. 3-U.P., Wilmington, Los Angeles	3- 5-13	2,177	sd. sh. drlg.
Bankline Oil, No. 4-U.P., Wilmington, Los Angeles	3- 5-13	3,892	O.S. drlg.
Bankline Oil Co., No. 5-U.P. Wilmington, Los Angeles	2- 5-13	2,760	O.S. drlg.
Baker Oil, No. 1 Wilmington, Los Angeles	35- 4-13	3,078	cmtd. 3,077
Caminol, No. 2-7-H Wilmington, Los Angeles	2- 5-13	981	sd. sh. drlg.
Hancock Oil, No. 1-A Wilmington, Los Angeles	2- 5-13	3,900	flw. 3,990 b.d.
Hancock Oil, No. 2-A Wilmington, Los Angeles	2- 5-13	3,761	O.S. drlg.
Hancock Oil, No. 6-E Wilmington, Los Angeles	2- 5-13	2,198	sd. sh. drlg.
L. B. Harbor Oil, No. 1-CC, Wilmington, Los Angeles	2- 5-13	3,805	flw. 4,330 b.d.
L. B. Harbor Oil, No. 2-CC, Wilmington, Los Angeles	2- 5-13	2,286	sd. sh. drlg.
Macson Oil, No. 2-C Wilmington, Los Angeles	32- 4-13	3,638	rig to pump
Pongratz, Gus, 2-A Wilmington, Los Angeles	32- 4-13	2,970	sd. sh. drlg.
Pongratz, Gus, No. 2-G Wilmington, Los Angeles	32- 4-13	2,241	sd. sh. drlg.
Richfield Oil, No. 1-G Wilmington, Los Angeles	2- 5-13	4,898	sd. sh. drlg.
Richfield Oil, No. 2-R.O., Wilmington, Los Angeles	2- 5-13	943	sd. sh. drlg.
Richfield Oil, No. 1-S.D., Wilmington, Los Angeles	35- 4-13	3,334	pump 145 b.d.
Superior Oil, No. 1-B.B., Wilmington, Los Angeles	4- 5-13	2,940	flow 440 b.d.
Superior Oil, No. 5-B.B., Wilmington, Los Angeles	4- 5-13	2,940	flow 435 b.d.
Superior Oil, No. 14 B.B, Wilmington, Los Angeles	4- 5-13	2,737	sd. sh. drlg.
Texas Co, No. 2 Ref., Wilmington, Los Angeles	32- 4-13	3,472	sd. sh. drlg.
Union Pacific R.R., No. 46 Wilmington, Los Angeles	33- 4-13	2,860	flw. 1,172 b.d.
Union Pacific R.R., No. 49 Wilmington, Los Angeles	34- 4-13	3,778	O.S. drlg.
Union Pacific R.R., No. 51 Wilmington, Los Angeles	34- 4-13	2,767	sd. sh. drlg.
Union Pacific R.R., No. 70 Wilmington, Los Angeles	34- 4-13	2,194	sd. sh. drlg.
Union Pacific R. R., No. 71 Wilmington, Los Angeles	34- 4-13	2,540	sd. sh. drlg.
Union Pacific R.R., No. 72 Wilmington, Los Angeles	34- 4-13	2,265	sd. sh. drlg.
W. G. Oil, No. 1-A LBHD, Wilmington, Los Angeles	3- 5-13	1,468	sd. sh. drlg.
W. G. Oil, No. 2-A LBHD, Wilmington, Los Angeles	3- 5-13	1,984	sd. sh. drlg.
W. G. Oil, No. 3-A LBHD, Wilmington, Los Angeles	3- 5-13	2,041	sd. sh. drlg.
W. G. Oil, No. 4-A LBHD, Wilmington, Los Angeles	3- 5-13	1,986	sd. sh. drlg.
Johnston Drlg., No. 1 Montebello, Los Angeles	5- 2-11	2,691	sd. sh. drlg.
St. Helens Pet., No. 24-M Montebello, Los Angeles	2- 2-12	3,597	sd. sh. drlg.
Union Oil, No. 4 North Long Beach, Los Angeles	13- 4-13	4,448	flow 250 b.d.
Hilldon Oil, No. 2 North Long Beach, Los Angeles	13- 4-13	2,977	sd. sh. drlg.
Abrams, John, No. 1 Flood Control, Los Angeles	13- 4-13	4,230	tested wet
Kramildon Oil, No. 1 Long Beach, Los Angeles	13- 4-13	2,198	sd. sh. drlg.
Texas Co., No. 4 Gray, Long Beach, Los Angeles	20- 4-12	4,415	pump 45 b.d
Powers, E.D., No. 3 Long Beach, Los Angeles	20- 4-12	4,303	sd. sh. drlg.
Sunset Oil, No. 1 Whitney, Long Beach, Los Angeles	19- 4-12	3,095	sd. sh. drlg.
Shell Oil, No. 1 Hath, Long Beach, Los Angeles	28- 4-12	6,400	dry; abd.
Shell Oil, No. 15-C Long Beach, Los Angeles	19- 4-12	3,200	sd. sh. drlg.
Richfield Oil, No. 4-B, Long Beach, Los Angeles	13- 4-13	2,886	sd. sh. drlg.
Ramsey, W. E., No. 1 Monterey Park, Los Angeles	27- 1-12	3,630	sd. sh. drlg.
Union Oil, No. 100 Santa Fe Springs, Los Angeles	6- 3-11	11,314	P.B. 11,155
Continental Oil, No. 40 Bixby, Seal Beach, Orange	2- 5-12	7,501	redrlg. 6,570
W.P.R. Oil, No. 3 Huntington, Orange	35- 5-11	6,645	will P.B.
Lido Pet., No. 1 Severns, Huntington, Orange	34- 4-11	3,801	pulled pipe
Brea Canyon Oil, No. 48 Brea Canyon, Orange	2- 3-10	1,181	hd. sd. drlg.
Standard Oil, No. 127 Murphy, West Coyote, Orange	18- 3-10	3,240	cmtd. 3,224
Union Oil, No. 29 Chapman, Richfield, Orange	29- 3- 9	10,496	P.B. 4,610
Standard Oil, No. 2-26 Kraemer, Richfield, Orange	32- 3- 9	4,010	sd. sh. drlg.
Oil Income, No. 1 Anderson, Yorba, Orange	22- 3- 9	2,182	P.B. 1,779
Berco Oil, No. 1 Milhous, Yorba, Orange	22- 3- 9	1,750	pump 70 b.d
Fairfield, F. E., No. 1 Dutton, Yorba, Orange	22- 3- 9	1,662	bailing
Perl, J. Oil, No. 1-D Yorba, Orange	21- 3- 9	1,000	sd. sh. drlg.
Beth Pet., No. 1 Pickering, Yorba, Orange	21- 3- 9	2,290	O.S. drlg.
Selegna Oil, No. 1-A Chino, San Bernardino	12- 3- 8	3,050	gr. sd. drlg.

KANSAS

Week Ending February 19 (Descriptions are East unless marked otherwise)

Barber County

Carter Oil Co. et al No. 1 Ely, C NE NW sec. 6-32-14w. Drlg. 2,828 ft.
Palmer Oil Corp. et al No. 1 Warwick, C NW sec. 29-31-10w. Drlg. 3,980 ft.

Barton County

Crown Oil Co. No. 1 Schwartz, NW sec. 7-20-11w. Bad hole 1,008 ft.
R. E. Day et al No. 1 Felts, SE SE NE sec. 14-16-12w. S.D. 1,875 ft.
Martin & Foraker et al No. 1 Dick Est., NE SW SW sec. 31-19-11w. Rig.
C. L. Price No. 1 Hammeke, NE NE SW sec. 12-18-12w. Sil. 3,415-27 ft.; T.D. 3,433 ft.; P.B. 3,429 ft.; est. 20 B.O. P.D. and 2 B.W.
Sinclair Prairie Oil Co. No. 1 Frederick, SW SW SE sec. 16-16-11w. Set 8¼-in. csg. 504 ft.; W.O.C.
Sinclair Prairie Oil Co. No. 1 Oser, NE SE sec. 17-16-11w. Drlg. 3,115 ft.
Texas Co. No. 1 Lowry, CNL NW SW sec. 2-17-13w. T.D. 3,342 ft.; 200 ft. O.I.H.

Butler County

T. S. Dustin No. 1 Miley, SE NW NE sec. 17-27-5e. S.D. 810 ft.
Steinbuchel et al No. 1 Fox, NW SE NE sec. 25-26-3e. S.D. 1,010 ft.

Chase County

T. D. Duffy No. 1 Leedy, NE NW NW sec. 26-22-9. Drlg. 1,415 ft.

Clark County

Olson Oil Co. No. 1 Lenman, SE SW sec. 20-32-31w. Arb. 6,735 ft.; T.D. 6,807 ft.; making survey.
Olson Oil Co. et al No. 1 Watkins, SW NW sec. 23-32-21w. P.B. 6,810 ft.; W. O.C.

Cowley County

Arthur Brewer No. 1 Clark, NE SE NW sec. 6-31-4. Bville. 2,860-70 ft.; 600 ft. O.I.H. in 3 hrs.; set 5-in. csg.
Dickey Oil Co. No. 1 Kansas G. & E., NE cor. sec. 22-34-3e. Arb. 3,735-90 ft., T.D.; D.&A.
Tom Palmer No. 1 Neimaller, NE cor. sec. 14-30-4e. Drlg. 2,255 ft.
Trees Oil Co. and Talbott No. 1 McMinn, NE NW sec. 16-31-6. Miss. L. 2,903 ft.; S.D.
Earl Wakefield No. 1 White, NW NE sec. 4-33-4e. Drlg. 1,550 ft.

Ellis County

Central Pet. Co. No. 1 Foster, CSL SE NW sec. 33-11-16w. Drlg. 2,166 ft.
Colonial Oil Co., Trott et al No. 1 Hadley, SE NE SE sec. 12-11-8w. T.D. 3,-146 ft.; drlg. cmt.
Hays & Sackrider No. 1 Windholtz, NE cor. sec. 2-13-16w. S.S.O. 2,930-35 ft.; S.S.G. 3,010-15 ft.
J. J. Muth et al No. 1 Penney, C N½ NE SE sec. 29-14-18w. S.D. 350 ft.

Ellsworth County

Cities Service Oil Co. et al No. 1 Schroeder, C N½ N½ NW sec. 29-17-9w. Arb. 3,205 ft. (cor.); T.D. 3,215 ft.; pot. 1,321 B.O.; acd.; new pot. 2,644 B.O.; comp.
Colonial Oil Co. No. 1 Hogy, NW cor. sec. 16-16-10w. T.D. 3,342 ft.; set 6-in. 3,-332 ft.
Ralph Wixson et al No. 1 Peterman, SW cor. sec. 28-17-10w. T.D. 3,306 ft.; est. ¼ B.O.P.H.

Greenwood County

Landon & Mendenhall No. 1 Slough, NE SW sec. 9-24-13e. Drlg. 1,675 ft.
John Nichols et al No. 1 Central Life, SE SW sec. 35-25-12. Spd. and S.D.
C. C. Whitaker et al No. 1 Bressner, NW SE sec. 8-26-13e. Drlg. 300 ft.

Harper County

Franklin Drlg. Co. No. 1 Walts, NE SW sec. 24-34-6w. Drlg. 3,980 ft.

Harvey County

National Ref. Co. No. 1 Brown Bros., NW SE NE sec. 22-23-2w. Drlg. 3,-400 ft.

Jackson County

Lemmick Oil Co. No. 1 Marble Savings Bank, NE cor. sec. 26-9-14. S.D. 510 ft.

Jewell County

Hollingsworth Bros. No. 1 Wolfe, NE SW SE sec. 14-4s-8w. S.D. 100 ft.

Lane County

Phillips Pet. Co. No. 1 Kees, C SE SE sec. 3-19-30w. S.D. 4,885 ft.

McPherson County

Archer & Crane No. 1 Templin, NW SW SE sec. 32-17-3w. Drlg. 3,025 ft.
Darrah et al No. 1 Decker, SW SW SE sec. 12-21-2w. Drlg. 750 ft.

Meade County

Pacific Mid-West Co. No. 1 Rexford, NE SE SW sec. 8-30-29w. S.D. 200 ft.; (cor.).

Ness County

Marshall Drlg. Co. et al No. 1 Anderson, SW NW sec. 23-16-24w. Spd. and S.D.
Trojan O. & G. Co. No. 1 Moses, C SW NW sec. 10-18-25w. S.D. 500 ft.
Trojan O. & G. Co. No. 1 Page Milling Co., SE SE NW sec. 36-18-26w. C.O. 3,-265 ft.

Phillips County

C. W. Davidson et al No. 1 Elliff, SE NE NE sec. 35-5-18w. S.D. 600 ft.

Pratt County

Cities Service Oil Co. No. 1 Delaney, CNL S½ NE sec. 13-26-12w. Drlg. 1,-981 ft.

Reno County

Carey et al No. 1 McPheeters, NE NW sec. 22-26-8w. Drlg. 3,637 ft.
Cities Service Oil Co. No. 1 Kreie, C NW sec. 27-23-10w. Drlg. 2,600 ft.
McCole et al No. 1 Mathews, SW NW NW sec. 15-24-10w. U.R. 10-in. 2,230 ft.
Clyde Pulse No. 1 Payne, SW NW NE sec. 4-22-7w. Old T.D. 3,440 ft.; dpnd to 3,889 ft.; D.&A.
Skelly Oil Co., Kimmel & Stewart No. 1 Gorham, SW SE sec. 32-25-10w. Arb. 4,387 ft.; T.D. 4,403 ft.; D.&A.

Rice County

Cities Service Oil Co. et al No. 1 Habiger, SW NW sec. 18-18-9w. Drlg. 1,-785 ft.
Price et al No. 1 Gemeinhardt, NE SE sec. 18-18-10w. T.D. 3,298 ft.; acd.; pmpd. 2 B.O. in 45 min. and 1% wtr.
Sam Schneider et al No. 1 Sterling College, SE SW SE sec. 28-20-8w. Drlg. 2,220 ft.

Rooks County

Duwe & Farris No. 1 Hancock, NW SW SW sec. 21-10-18w. Drlg. 2,646 ft.
Elwell et al No. 1 Zimmerman, NE NW sec. 15-9-18w. S.D. 2,711 ft.
Graham et al No. 1 Fike, SW cor. sec. 9-9-17w. S.D. 3,370 ft.
Producers Oil Co. No. 1 Ham, SW SW NW sec. 25-7-19w. Set 12-in. 312 ft. (cor.); S.D. 330 ft.

Rush County

Duwe & Brouk No. 1 Lebsack, SE SE NE sec. 13-16-16w. Sil. 3,492-95 ft.; 1,500 ft. sulfur water in hole in 2½ hrs.; T.D. 3,512 ft.; S.D.O.

Russell County

Emrichs et al No. 1 Anderson, NE SE SW sec. 33-15-11w. Spd. and S.D.
Hess et al No. 1 Reinhardt, NE SW sec. 36-12-14w. S.S.O. 2,790 ft.; S.D.
Jones & Shelbourne et al No. 1 Kuhnle, SE NW sec. 4-15-12w. Drlg. 1,015 ft.
Parks et al No. 1 Gorham Est., SW NW sec. 19-15-15w. Drlg. 590 ft.
Simpson et al No. 1 Boxberger, NE SE NW sec. 10-15-14w. Spd.
G. A. Stearns et al No. 1 Stielow, NW cor. sec. 32-11-14w. Drlg. 785 ft.
Winkler & Koch No. 1 Jones, SE SE NW sec. 22-14-13w. Sil. 3,180 ft.; S.D.O.

Sedgwick County

Frank Hudson et al No. 1 Fulton, NE SE sec. 35-28-1e. Fsg. 1,550 ft.
McKnab No. 1 Garrett, SE SW SW sec. 18-29-2e. Drlg. 2,446 ft.
Steinbuchel et al No. 1 McAdams, SW NE sec. 28-20-1e. Drlg. 3,624 ft.
Union O. & R. Co. et al No. 1 Howell, SW cor. sec. 6-29-1e. C.O. 2,409 ft.

Stafford County

C. L. Carlock et al No. 1 Gates, SE SW

NE sec. 34-22-11w. Arb. 3,660 ft.; T.D. 3,669 ft.; D.&A.

Carter Oil Co. No. 1 Andress, CNL SE sec. 2-21-13w. T.D. 3,554 ft.; acd.

Cardinal Oil Co. et al No. 1 Sittner, SW cor. sec. 4-22-12w. T.D. 3,700 ft.; acd.; swbd. 30 B.W. and 5 B.O. in 30 hrs.

Ted Hamilton et al No. 1 Hitz, NE NW sec. 23-22-13w. Drlg. 3,605 ft.

Hipple et al No. 1 Moses, NW SW sec. 9-22-13w. H.F.W. 3,804-07 ft.; P.B. 3,-635 ft.; perf. csg. shot acd.

National Ref. Co. No. 1 Bonham, SW SE sec. 28-25-12w. Set 8-in. 3,605 ft.; R. U.S.T.

Fred Rust No. 1 Hullman, SW cor. sec. 5-22-12w. Arb. 3,832 ft.; T.D. 3,841 ft.; D.&A.

Stanolind O. & G. Co. No. 1 Hahn, NE NW sec. 14-22-13w. Drlg. 2,750 ft.

Stanolind O. & G. Co. No. 1 Hill, NE SW sec. 2-23-12w. Drlg. 3,246 ft.

Sumner County

Cities Service Oil Co. No. 1 McCoy, SE SW sec. 11-35-2e. Drlg. 3,690 ft.

Saco Oil Co. No. 1 Phipps, SW SE NE sec. 24-30-1w. Spd. and S.D.

E. B. Shawver No. 1 Stewart, NW SE sec. 4-32-3w. Drlg. 4,180 ft.

Trego County

Carlock No. 1 Kinzel, SW SW sec. 9-13 22w. Spd. and S.D.

Manning & Martin No. 1 Lynd, NW SW sec. 16-11-21w. Drlg. 600 ft.

NEBRASKA WILDCATS

Arab Pet. Corp. et al No. 1 Ogle, SE SE sec. 9-1n-14e. Viola 3,019 ft.; Granite sec. 9-1n-14e, Richardson County. Viola 3,019 ft.; Gran. 3,423 ft., T.D.; S.D.O.

OKLAHOMA

Week Ending February 19

NORTHERN OKLAHOMA

Beckham County

Mid-American Oil Co. No. 1-A Biscoe, SW cor. sec. 28-8-22w. Drlg. 2,660 ft.

Caddo County

Indian Terr. Illum. Oil Co. No. 1 Dome-Bo, C NE SE sec. 29-6-10w. T.D. 6,-900 ft.; to test shallow sds.

Cleveland County

W. A. Delaney et al No. 1 Bugher, SE SE SW sec. 12-7-2w. Rig.

Harper-Turner No. 1 Pollock, C W½ NW NW sec. 13-9-2w. T.D. 7,489 ft.; P.B. 6,620 ft.; drlg. at 6,931 ft.

Comanche County

Clyde Roach No. 1-A Green, SE SE SW sec. 2-1n-13w. S.D. 550 ft.

Creek County

M. W. Mosier et al No. 1 Holcomb, SE SW NW sec. 19-18-8. T.D. 3,018 ft.; 2,-000 ft. W.I.H. and S.S.O.; S.D.

Garfield County

H. R. Hollenback et al No. 1 Clark, NW cor. sec. 34-21-6w. Second Wilcox 7,-298 ft.; T.D. 7,336 ft.; perf. csg. 7,259-70 ft.; made head flow; est. 10 B.O. P.H. and 3,000,000 ft. of gas; S.I.; may acidize.

Garvin County

B. C. D. Edwards No. 1 Clark, NE cor. sec. 16-3n-3e. T.D. 2,676 ft.; P.B. 2,088 ft.; perf.; swb. 6 bbls. fluid in 1 hr.; est. half wtr.; R.U.S.T.

Grady County

Doyle Pet. Co. No. 1 Huffine, NW NW SE sec. 30-5-8w. Drlg.

Gulf Oil Corp. No. 1 Thomas, SW NW NW sec. 14-4-5w. Drlg. 10,553 ft.

Greer County

R. W. McDonald No. 1 Fite, SE SE sec. 34-7-21w. Drlg. 992 ft.

J. I. Medlin et al No. 1 Broudie, NW cor. sec. 5-6n-20w. T.D. 90 ft.; (cor.); S.D.

Hughes County

Homer Doup et al No. 1 Bank, NE NE NW sec. 7-7-9. Fsg. 335 ft.

Phillips Pet. Co. No. 1 Becker, NE NW SW sec. 8-5-10. T.D. 6,286 ft.; P.B. 5,-760 ft.; to test First Wilcox sd.

Kay County

F. S. Freeland et al No. 1-A Watson, NE NW NW sec. 28-28-1w. Rig on ground.

E. J. Shaffer et al No. 1 McKee, NE NW sec. 20-28-1w. T.D. 2,500 ft.; S.D.

Kiowa County

Gauntt & Baker No. 1 Parks, NW NW SW sec. 29-7-20w. S.D. 720 ft.

Hughes & Reese No. 1 Fultz, SE cor. sec. 10-6-18w. T.D. 1,238 ft.; S.D.

Logan County

Arrow Drlg. Co. No. 1 Dodson, NW cor. sec. 23-17-1w. S.D. for repairs at 5,-046 ft.

Stanolind O. & G. Co. No. 1 Blunt B, C W½ W½ NW sec. 6-14-3w. T.D. 6,495 ft.; may abd.

Okfuskee County

Broswood Oil Co. No. 1 Lehman, NW SW NW sec. 21-13-10. Dutcher 2,851-65 ft.; T.D. 2,866 ft.; swbd. 47½ B.O. in 24 hrs.; to pmp.

Oklahoma County

W. O. Allen et al No. 1 Jackson, C E½ SE NW sec. 6-14-3w. Drlg. 6,245 ft.

Okmulgee County

H. D. Detrick et al No. 1 McCann, NW SE SW sec. 33-14-11. Drlg. 1,000 ft.

Phillips Pet. Co. No. 1 Wood, NW SW SW sec. 31-11-13. Drlg. 3,665 ft.

Osage County

Norbia Oil Co. and Carter Oil Co. No. 1 Osage, NW cor. sec. 3-24-6. Drlg. 1,-967 ft.

Payne County

Helmerich & Payne No. 1 Ritchie, C NE NW sec. 34-18-1e. Drlg. 3,823 ft.

Pontotoc County

Cawley et al No. 1 McCormick, NW SW SW SE sec. 27-2n-4e. Drlg. 80 ft.

H. W. Lee No. 1 Weatherly, NW SE NW sec. 24-1n-7. Set 12½-in. csg. 243 ft.; drlg. 280 ft.

Jack Lynch et al No. 1-A Parker, SW SW SE sec. 17-4-8. Spd.

H. Riddle et al No. 1 fee, NW SW SE sec. 11-3n-5e. T.D. 4,490 ft.; D.&A.

Union Dev. Co. No. 1 Abbott, SW NW NE sec. 34-3-6. T.D. 3,320 ft.; fsg.

Pottawatomie County

Hall & O'Mara No. 1 Shaw, NE NE SE sec. 32-6-5. Drlg. 1,850 ft.

Seminole County

C. E. Davis et al No. 1 Jones, NW NE SW sec. 34-6-5. Drlg. 1,850 ft.

W. B. Pine No. 1 Wright, SE SE NE sec. 16-6-6. Set 10-in. csg. 109 ft.

H. V. Woodson and Marydun Oil Co. No 1 Gilliland, SE SW sec. 24-11-7. T.D. 4,295 ft.; H.F.W. after test.

Texas County

Hagey et al No. 1 Peck, C NE sec. 6-1n-13ecm. T.D. 2,842 ft.; C.O.

Harkendorf & Kuhn No. 1 Wiggins, C NW sec. 1-2n-14ecm. Drlg. 1,775 ft.

Washita County

L. B. McWhirter No. 1 fee, NW SW SW sec. 34-8-19w. Drlg. 2,037 ft.

SOUTHERN OKLAHOMA

Atoka County

Amerada Pet. Corp. and Stanolind O. & G. Co. No. 1 Ridgway, NE cor. sec. 24-3s-9. Drlg. 2,155 ft.

C. M. Sheldon and Gardner Pet. Co. No. 1 Lee, NE NW SW sec. 2-4s-10e. S.D. 2,416 ft.

Bryan County

Southern Oil Co. No. 1 Henry, NW NW NE sec. 10-8s-7. Drlg. 3,675 ft.

Choctaw County

V. K. Chapman and T. N. Low No. 1 Hallum, NE NW NW sec. 4-7s-20. S.D. 675 ft.

J. A. True No. 1 Boby, C NW SW sec. 17-7s-19e. T.D. 2,175 ft.; T.A.

Cotton County

Jim Turner et al No. 1-A Collins, SW NE NE sec. 18-4s-10w. Sd. 1,234 ft.; S.D. for csg.

Jefferson County

Massad & Swansberger No. 1 Barrett, NE SE SE sec. 14-6s-6w. T.D. 1,890 ft.; S.D.

Johnston County

Patton et al No. 1 McCrummins, C SW SW NE sec. 16-1s-6e. S.D. 1,380 ft.

W. T. Sheldon No. 1 Chapman, C NW NW sec. 26-4s-6e. T.D. 3,176 ft.; fsg.

Love County

Sinclair Prairie Oil Co. No. 1 Peabody, NE cor. sec. 35-6s-2w. Set 13⅜-in. csg. 910 ft.; T.D. 1,005 ft.

Stephens County

Coline Oil Co. No. 1 Johnson, C SW SE SE NE sec. 1-2n-8w. T.D. 10,000 ft.; P.B. and drld. to 9,086 ft.; bailing and C.O.

Helmerich & Payne No. 1 Pfile, SW cor. sec. 1-2s-7w. T.D. 4,246 ft.; P.B. 4,020 ft.; tstd. wtr.

Robinson et al No. 1 Alexander, NW NE NW SE sec. 30-2n-4w. S.D. 380 ft.

Schmoerke No. 1-A Sadler, SW NW NW SE sec. 30-2n-4w. S.D. 580 ft.

Tillman County

Barney Cockburn et al No. 1 Nicholas, SE cor. sec. 28-2s-19w. O.W.D.D.; drlg. 3,025 ft.

H. I. Grimes et al No. 1 Laney, NW cor. sec. 3-3s-18w. Drlg. 2,135 ft.

Indian Terr. Illum. Oil Co. No. 1 Drum, C N½ SW NW sec. 32-2s-17w. T.D. 3,843 ft.; abd.

M. G. Martin No. 1 Parris, NW NW SW sec. 3-3s-19w. T.D. 2,135 ft.; whipstk. 1,560 ft.; drlg. 1,840 ft. in new hole.

Smith No. 2 Hammell, NE NW NW sec. 6-5s-15w. T.D. 1,581 ft.; S.D.

LOUISIANA

NORTH LOUISIANA PROVEN

Caddo—Rodessa

F. W. Burford No. 1 Brown, NE cor. SE sec. 5-23-16. Cg. 5,935 ft.

J. S. Rushing No. 1 Alexander, NW cor. sec. 3-23-16. T.D. 5,347 ft.; D.S. stk.

Shell Pet. Corp. No. 1-B Govt., SE cor. SW SE sec. 3-23-16. Drlg. sh. 980 ft.

Standard Oil Co. of La. No. 1 Rodessa Oil & Ld. Co., NE cor. NE NE sec. 10-23-16. Drlg. 5,663 ft.

Standard Oil Co. of La. No. 2 Spearman, SE cor. SE SE sec. 3-23-16. Drlg. 2,-147 ft.

Union Prod. Co. No. 7 Harris, NW cor. NE sec. 10-23-16. Cg. 5,769 ft.

N. LOUISIANA WILDCATS

Bienville Parish

Gulf Ref. Co. No. 1 Goodpine, sec. 25-14-8. Drlg. sh. 8,122 ft.

Bossier Parish

L. W. Dennis No. 1 Roos, SW NW NW sec. 13-19-12. Perf. 840-42 ft.; tstd. S.W.; recmtd. 8¼-in. 855 ft.; T.D. 864 ft.

C. H. French No. 2 Larkin, NW cor. SE sec. 14-19-11. S.D. 225 ft.

Premier Inv. Co. No. 1 McDade, SE SW NE sec. 28-19-11. S.D. 1,650 ft.; rep. rig.

Triangle Drlg. Co. No. 2-A Herold, NW cor. sec. 13-17-12. Sat. L. 3,116-19 ft.; set 5½-in. csg. 3,110 ft.; T.D. 3,125 ft. O.I.H.; installing flow valves.

Caddo Parish

Anderson & Gilbert No. 1 Pittman, SE cor. SW sec. 14-19-14. Cg. 2,390 ft.

Ardsell Oil Co. and H. W. Russell No. 2 Muslow, sec. 26-21-16. O.W.W.O.; T.D. 2,246 ft.; set 5⅛-in. csg. 2,205 ft.; W. O.S.R.

W. D. Chew No. 4 Spell, SE sec. 29-21-15. S.D. 1,517 ft.; high wtr.

L. T. Davis No. 3 Styles, SE cor. sec. 17-21-16. Drlg. sh. 780 ft.

Double "I" Oil Co. No. 1 Goodwin, NW cor. sec. 33-21-15. Set 6-in. csg. 1,410 ft.; W.O.S.R.; T.D. 1,630 ft.

J. P. Driscoll et al No. 2 Muslow, SE cor. NE NW sec. 4-20-15. S.D. 1,700 ft.; high wtr.

W. D. Flynn No. 3 Natalie, SW cor. sec. 10-21-16. T.D. 1,029 ft.; W.O.S.R.

W. D. Flynn No. 4 Natalie, SE cor. sec. 10-21-16. R.U.

W. H. Harrison, Jr., No. 3 Crystal Shoreline, SW cor. SW NW sec. 25-21-16. Set 4-in. csg. 2,255 ft.; T.D. 2,264 ft.

Louisiana Oil Prod. Co. No. 14-B Muslow, sec. 4-20-15. S.D. 2,130 ft.; high wtr.

Magnolia Pet. Co. No. 24 Dillon Hrs., NW cor. NE NE sec. 23-21-15. Drlg. sh. 968 ft.

J. F. Mitchell No. 1 Muslow, NE cor. sec. 31-21-15. Tstg. 1,600 ft.

Olson Drlg. Co. No. 1 Sharp, C NW NE sec. 10-18-16. Drlg. sh.&L. 3,983 ft.

Petroleum Heat & Power Co. No. 1 Wemple. NW cor. sec. 14-20-15. Drlg. sh. 2,010 ft.

S. M. Richardson No. 2 Sentell, sec. 9-19-14. Drlg. 2,010 ft.

A. D. Robinson No. 1 Wilkinson, sec. 22-20-14. T.D. 2,805 ft.; P.B. 2,450 ft.; W.O.C.

3-Sands Oil Co. No. 1 Player, 330 ft. S and E, C sec. 26-21-15. Set 4½-in. csg. 2,224 ft.; T.D. 2,233 ft.; bailing to tst.

J. E. Sedberry No. 1 Dickinson, NW sec. 15-19-14. Set 6-in. csg. 2,443 ft.; W.O. S.R. 2,505 ft.

Raymond Wright No. 1 Hobbs, NE cor. sec. 29-21-15. Tstd. oil 1,635 ft.; arg. to acdz.

Simplex Oil Co. No. 6 Natalie, sec. 10-20-15. Set 10-in. csg. 80 ft.; S.D. 700 ft.

Claiborne Parish

Atlantic Ref. Co. No. 2-D Patton, C S½ SE SE sec. 29-21-4. T.D. 5,246 ft.; set 5½-in. csg. 5,228 ft.; comp.; 58 B.P. H.; ¾-in. ck.

Gulf Oil Corp. No. 1 McDonald, NW cor. SE NE sec. 2-20-5. Set 10¾-in. csg. 714 ft.

Hollifield & McFarland No. 3 Patton Est., SE cor. SE NE sec. 2-20-5. Drlg. 95 ft.

T. L. James No. 2 Fowler, NE SW sec. 32-21-4. T.D. 5,190 ft.; set 5½-in. csg.; tstg. 5,190 ft.

J. R. McMurray No. 1 Bean, C N½ SE NW sec. 32-21-4. T.D. 5,167 ft.; set 5½-in. csg.; comp.; 500 B.P.D.; 21/64-in. ck.

A. O. Olson et al No. 2 English, NE SE sec. 29-21-4. Set 7-in. csg. 5,153 ft.; tstg.; T.D. 5,168 ft.; comp.; 70 B.P.H.; ¾-in. ck.

A. O. Olson et al No. 7-A Patton, sec. 30-21-4. Sat. L. 5,071-74 ft. and 5,077-80 ft.; set 7-in. csg. 5,070 ft.; T.D. 5,-082 ft.

Scout Oil Corp. No. 2 Bean, NE cor. SW sec. 32-21-4. R.U.

Sloan & Zook No. 2 Patton, SE NW sec. 1-20-5. Drlg. sh.&L. 4,797 ft.

Texas Canadian Oil Co. No. 1 Tanner, C N½ SE NE sec. 32-21-4. Drlg. 3,-221 ft.

Tippett Oil Corp. No. 1 Aycock, SE sec. 1-20-5. Drlg. 4,945 ft.

Union Prod. Co. No. 2 Brownfield, sec 5-19-5. T.D. 9,964 ft.; sh.; trying to straighten hole; P.B. depth 8,930 ft.

Union Prod. Co. No. 1-A Kilpatrick, sec. 11-19-6. Rmg. 5,971 ft.

G. H. Vaughn No. 3 King, C S½ sec. 30-21-4. Drlg. red sh. 3,489 ft.

De Soto Parish

A. P. Barrett No. 1 Jal Drlg. Co., NW cor. SE SW sec. 7-11-11. Set 6⅝-in. csg. 2,777 ft.; T.D. 2,809 ft.; W.O.S.R.

Pet. Heat & Power Co. No. 1 DeSoto Corp., SE cor. SW NW sec. 7-11-11. Missed sd.; S.D.; T.D. sh. 2,868 ft.

Pet. Heat & Power Co. No. 1 Jal Drlg. Co., SW cor. SE NW sec. 7-11-11. Set 7-in. csg. 2,744 ft.; T.D. 2,792 ft.; comp. 7½ B.P.H.; ½-in. ck.

Pet. Heat & Power Co. No. 1 Matthews, sec. 29-12-11. S.D. 2,685 ft.; rep. rig.

Pet. Heat & Power Co. No. 2 Matthews, sec. 30-12-11. S.D.; rep. rig., 1,900 ft.

Pet. Heat & Power Co. No. 1 Taylor, NE cor. NE SE sec. 12-11-12. Drlg. 3,595 ft.

Pet. Heat & Power Co. No. 2 Taylor, sec. 12-11-12. Drk.

Pet. Heat & Power No. 1 Williams Est., NE cor. SW SE sec. 12-11-12. Drlg. 1,750 ft.

Pet. Heat & Power No. 1 Williams, W. R., NW NE sec. 13-11-12. Set 10-in. csg. 185 ft.

Franklin Parish

Southern Star Pet. Co. No. 2 Grayson, NE cor. NE SE sec. 36-12-6e. S.D. 1,-754 ft.

La Salle Parish

Pet. Heat & Power Co. No. 1 Gaharan, Lot 7, Blk. 1, Holmes & Adams Addn., sec. 25-10-1e. Set 6-in. csg. 1,530 ft.; T.D. 1,541 ft.

Placid Oil Co. No. 5 La. Cent., sec. 12-9-2e. Set 10-in. csg. 100 ft.; D.&A.

Stovall, Tr., No. 4 Russell, SE SE sec. 25-10-1e. 6-in. csg. at T.D. 1,518 ft.; W.O.S.R.

Lincoln Parish

F. H. Brown No. 2 Patton, C S½ SE SW sec. 6-20-4. R.U.

Delta Drlg. Co. No. 1 Weiss & Tatum, C S½ NW NE sec. 7-20-4. T.D. 5,341 ft.; 7-in. csg. 5,324 ft.; comp.; 43 B. P.H. on ½-in. ck.

Love Bros. No. 2 Patton Est., sec. 6-20-4. Set 5⅛-in. csg. 5,294 ft.; T.D. 5,316 ft.; comp.; 21 B.P.H. on 12/64-in. ck.;

Magnolia Pet. Co. No. 1 Patton Est., NE cor. NW sec. 7-20-4. Drlg. 4,275 ft.

Magnolia Pet. Co. No. 1 Pollack, C N½ NE SE sec. 6-20-4. T.D. 5,327 ft.; swbg. to test.

Magnolia Pet. Co. No. 2 Pollock, C S½ NE SE sec. 6-20-4. R.U.

E. T. Oakes & Easton No. 1 Griggs, sec. 36-18-1w. T.D. 6,259 ft.; W.O.; S.D.

Morehouse Parish

W. J. Furlong No. 1 Clark, sec. 10-20-7e. Set 9⅝-in. csg. 2,805 ft.; wsg. to bttm.; S.D.; hd. sh. 6,142 ft.

Natchitoches Parish

Jos. E. Popkins No. 1 Peavy Lbr. Co., NW sec. 36-7n-9w. R.U.; S.D.

Red River Parish

Glassell & Whitehurst No. 1 LeLong, NE NW NE sec. 25-12-11. W.O.; D.S. 1,-810 ft.

Yandell Rogers No. 5 Gaspair, SE SW sec. 27-13-11. Set 5⅛-in. csg. 2,453 ft.; T.D. 2,462 ft.

Sabine Parish

Hunter Co. No. 2 Bowman, C SW NE

McGREGOR

12 Different Types of Working Barrels

OUR aim is to satisfy our customers by supplying them with a complete line of equipment for pumping wells. Our line includes:

Brass, Steel and Cast Iron Working Barrels
New "MAC" Plunger Barrel
Working, Standing and Drop Valves
Balls and Seats, etc.

Send for Booklet

McGREGOR WORKING BARREL COMPANY
Bradford, Pa., U.S.A.

sec. 12-17-13. Set 6-in. csg. 2,139 ft.; T.D. 2,563 ft.; O.I.H.; W.S.R.
Major Oil Co. No. 1 Henry, SE cor. NE SW sec. 12-7-13. R.U.
H. N. Morris No. 1 Irving & Bishop, C NW NW sec. 18-7-12. Set 12-in. at 80 ft.
Pearl Oil Corp. No. 7 Crawford, SW cor. SW SE sec. 20-9-13. R.U.
Sutton-Zwolle Oil Co. No. 1 Sabine Lbr. Co., SE cor. NW NE sec. 23-7n-14w. Set 9⅝-in. csg. 2,215 ft.; tstg. 2,450 ft.

Tensas Parish

W. L. Posey No. 1 Ramirez, C NW NW sec. 12-7-13. R.U.

Union Parish

Joe Modisett No. 1 Frost Lbr., sec. 14-21-1e. T.D. 7,005 ft.; M.I. heavy rig; bldg.; R.U. to D.D.

Webster Parish

S. W. L. Backus No. 4 Pardee Co., NE sec. 3-22-11. R.U.
Hunt Oil Co. No. 6 Babb, C NE SW sec. 14-21-10. R.U.
Hunt Oil Co. No. 8 Davis, C NW NE sec. 23-21-10. R.U.
H. L. Hunt Oil Co. No. 1 Hope, C SW NW sec. 24-21-10. Set 7-in. csg. 5,838 ft.; T.D. 5,852 ft.; comp.; 20 B.P.H.; 10/64-in. ck.
Hunt Oil Co. No. 19 Hope, NW cor. sec. 24-21-10. O.W.W.O.; arng. to D.D.
C. E. Lunsford No. 1 Turner, SW cor. SE sec. 20-20-8. S.D. 2,309 ft.
Magnolia Pet. Co. No. 1 Coyle-Tiner, C sec. 21-21-10. Set surf. csg. 824 ft.
Magnolia Pet. Co. No. 2 Crichton, SE cor. NE NW sec. 33-21-10. R.U.
Ohio Oil Co. No. 5 Holloway, NE cor. SE NE sec. 23-21-10. O.W.W.O.; R.U. to deepen.
Magnolia Pet. Co. No. 2 Mixon, sec. 22-21-10. Top Bodcaw sd. 8,300 ft.; set 7-in. csg.; T.D. 8,320 ft.
Magnolia Pet. Co. No. 1 Sexton Unit, NW SE sec. 32-23-9. Drlg. hd. sd.&sh. 7,231 ft.
North American Oil Co. and Root Pet. Co. No. 1 Coyle, NE SW sec. 28-21-10. Set 7-in. csg. 8,330 ft.
North American Oil Consol. Co. No. 1 Stewart, C SE NE sec. 32-27-10. Set 9⅝-in. csg. 5,866 ft.; T.D. 5,906 ft.; swbg. est. 100 B.P.D. oil.
Ohio Oil Co. No. 2 Bodcaw Acct. 4, SW SE NW sec. 24-21-10. Set 7-in. csg. 8,166 ft.; T.D. 8,222 ft.
Ohio Oil Co. No. 48 Bodcaw Acct. 2, SE sec. 15-21-10. Set 7-in. csg. 8,360 ft.; tstg. 8,410 ft.
Ohio Oil Co. No. 49 Bodcaw (Acct. 3), C NW NW sec. 34-21-10. Set 13⅜-in. csg. 808 ft.; drlg. L. 4,002 ft.
Ohio Oil Co. No. 1 Crutsinger, NE cor. sec. 35-21-10. Drlg. L. 3,510 ft.
Ohio Oil Co. No. 23 Gray Acct. No. 1, SE sec. 27-21-10. Drlg. sh. 7,920 ft.
A. G. Oliphant No. 2 Banks, C SE NW sec. 34-21-10. Holloway sd. 5,740-57 ft.; set 9⅝-in. csg. 5,728 ft.; T.D. 5,804 ft. comp.; 852 B.P.D.; ¼-in. ck.
A. G. Oliphant No. 1 Central Inv. Co., C NW SE sec. 33-21-10. Drlg. L.&sh. 4,663 ft.
A. G. Oliphant No. 1 Stewart, sec. 33-21-10. Drlg. sh. and anhy. 4,271 ft.
Stanolind O. & G. Co. No. 1 Pardee Co., SW NE sec. 36-21-10. T.D. 6,003 ft.; set 9⅝-in. csg. 5,992 ft.
Union Prod. Co. No. 1 Stewart, SE cor. SE sec. 28-21-10. Set 9⅝-in. csg. 5,798 ft.; T.D. 5,860 ft.

Winn Parish

G. W. Ziegen No. 13 La. Cen. Lbr. Co., sec. 4-13-1e. 12-in. at 62 ft.; W.O.C.

SOUTH LOUISIANA FIELDS

Anse La Butte—St. Martin Parish

Crusader Oil Co. No. 2 Central Oil Co., sec. 36-9s-5e. Core sdy. sh. 1,880 ft.
Austin B. Taglar No. 4 Begnaud, sec. 113-9s-6e. T.D. 1,970 ft.; 7-in. csg. 1,916 ft.; perf. csg. 912-20 ft.; swbd. S.W.; abd.
Austin B. Taylor No. 5 Begnaud, sec. 117-9s-5e. 7-in. csg. 826 ft.; drlg. sd. 1,473 ft.

Bay St. Elaine—Terrebonne Parish

F. J. LeBlanc No. 2 Wurzlow, sec. 17-22s-18e. S.D. 816 ft.

LEGAL NOTICE

Call for Bids to purchase royalty oil accruing to the United States from the Lance Creek, Wyoming, oil field. Sealed proposals, in duplicate, will be received in the office of the Secretary of the Interior, Washington, D. C., on or before noon, February 28, 1938, from responsible bidders for the purchase, beginning April 1, 1938, of royalty oil accruing to the United States from Government lands in the Lance Creek, Wyoming, oil field. Detailed specifications on quantities offered for sale, required form of bids, deliveries, volume measurements, gravity determinations, bond requirements, and action on bids, should be obtained by prospective bidders from the Director, Geological Survey, Department of the Interior, Washington, D. C.; the oil and gas Supervisor, Geological Survey, Casper, Wyoming; or the Register, U. S. Land Office, Cheyenne, Wyoming. Sealed bids are to be submitted to the Secretary, Department of the Interior, Washington, D. C., pursuant to the specifications, the envelope to be marked plainly "Bid on Lance Creek royalty oil, not to be opened before noon, February 28, 1938." No bid received after the time fixed herein for submitting bids will be considered. (Sgd.) Harold L. Ickes, Secretary of the Interior.

Bayou Blue—Iberville Parish

Humble O. & R. Co. No. 1 Schwing, sec. 67-9s-11e. Top sd. show oil 6,827 ft.; 7-in. csg. 6,828 ft.; core sd. 6,949 ft.

Bayou Cocotrix—Terrebonne Parish

Shell Pet. Corp. No. 4-B Realty Operators, sec. 17-17s-15e. 10¾-in. csg. 2,456 ft.; drlg. sh. 5,450 ft.

Bayou De Allemands—St. Charles Parish

Amerada Pet. Corp. No. 1 St. Charles Ld. Co., sec. 38-15s-20e. 10¾-in. csg. 2,698 ft.; top salt 9,255 ft.; T.D. 9,263 ft.; 7-in. csg. 7,200 ft.; Schlumberger shwd. 7¾ ohms, 130 millivolts; P.B. 6,940 ft.; perf. csg. 6,928-31 ft.; D.S.T. showed S.W.; slight gas show; squeezed off perf.; set retainer at 6,886 ft.; drld. out to 6,940 ft.; perf. csg. 6,909-20 ft.; tstd. S.W.; set retainer 6,898 ft.; sqzd. off perf.; perf. csg. 6,810-15 ft.; shwd. S.D. on D.S.T.; sqzd. off perf.; perf. csg. 6,783-87 ft.; tstd. S.W.; sqzd. off perf.; prep. to test 5,545-55 ft.
Amerada Pet. Corp. No. 1 Gheens Realty Co., sec. 56-15s-20e. Drk.

Big Lake—Cameron Parish

Union Sulphur Co. No. 2 Miami Corp., sec. 19-12s-8w. T.D. 7,924 ft.; P.B. 7,650 ft.; to sdtrk.

Black Bayou—Calcasieu Parish

Shell Pet. Corp. No. 40 Watkins. Cg. sd. 5,343 ft.

Bosco—Acadia Parish

Superior Oil Co.-Pure Oil Co. No. 5 Larcade, sec. 35-8s-3e. T.D. 10,216 ft.; P.B.: sdtrkd.; T.D. 9,927 ft.; 9⅝-in. csg. 7,536 ft.; T.D. 10,326 ft.; P.B. 9,423 ft.; T.D. 10,434 ft.; P.B. 8,879 ft.; perf. csg. 8,075-85 ft.; I.P. 184 B.P.D.; 8/64-in. ck.

Edgerly—Calcasieu Parish

La. Crusader Oil Co. No. 1 La. Prairie, sec. 21-9s-11w. T.D. 5,108 ft.; P.B. and sdtrk.; T.D. 3,082 ft.; P.B. and S.T. 2,350 ft.; drlg. sh. 2,866 ft.

Cameron Meadows—Cameron

Burton-Sutton Oil Co. No. 22 Sch. Ld., sec. 16-14s-13w. Drlg. sd. 2,401 ft.
Magnolia Pet. Co. No. 22 Cameron Meadows, sec. 21-14s-13w. Drk.

Cheneyville—Rapides Parish

Amerada Pet. Corp. No. 4 Weil, sec. 53-1s-2e. Cg. sh. 6,430 ft.

Charenton—St. Mary Parish

Pan American Prod. Co. No. 1 Eucer, sec. 11-13s-9e. T.D. 10,317 ft.; D.S. stuck.; fsg.; P.B. 2,640 ft.; 7-in. csg. 2,618 ft.; I.P. 389 B.P.D.; ¼-in. ck.
Pan American Prod. Co. No. 1 Robichauv, sec. 11-13s-9e. T.D. 1,906 ft.; 7-in. csg. 1,848 ft.; drld. out to 1,967 ft.; P.B. 890 ft.; sdtrkd.; T.D. 1,932 ft.; abd.
Pan American Prod. Co. No. 3 South Coast Corp., sec. 30-18s-10e. Drlg. sh. 1,900 ft.

Choctaw—Iberville Parish

Louisiana Crusader Oil Co. No. 1 E. B. Schwing, sec. 29-8s-11e. T.D. 8,969 ft.; well tried to blow out; stk. D.S.; fsg.
Standard Oil Co. No. 8 Gay, sec. 52-9s-11e. T.D. 6,125 ft.; fsg.

Darrow—Ascension Parish

Kiva Oil Co. No. 1 Duplessis, sec. 69-10s-2w. T.D. 60 ft.; S.D.
Humble O. & R. Co. No. 2 Landry, sec. 34-10s-2e. T.D. 6,952 ft.; 7-in. csg. 6,941 ft.; W.O.C.

Dog Lake—Terrebonne Parish

Texas Co. No. 21 State, sec. 5-22s-16e. T.D. 7,095 ft.; running Schlumberger survey.

Fausse Point—Iberia Parish

Texas Co. No. 4 State, sec. 35-11s-8e. 18⅝-in. csg. 90 ft.; top sd. 7,912 ft.; core sd. 7,927 ft.

Four Isle—Terrebonne Parish

Texas Co. No. 9 L.L.&E., sec. 24-21s-16e. T.D. 8,553 ft.; P.B. 3,881 ft.; sdtrk.; T.D. 6,943 ft.; 9⅝-in. csg. 6,870 ft.; drlg. sh. 8,617 ft.

Garden Island—Plaquemines Parish

Texas Co. No. 18 State, sec. 37-23s-33e. T.D. 5,064 ft.; mixing mud.
Texas Co. No. 26 state, sec. 37-23s-33e. Drlg. sdy. sh. 4,353 ft.

Gillis—Calcasieu Parish

Union Sulphur Co. No. 2 Mary McIvor, sec. 14-9s-8w. T.D. 7,165 ft.; 5-in. csg. 7,165 ft.; P.B. 7,137 ft.; S.D.
Union Sulphur Co. No. 6 Kaufman, sec. 13-9s-8w. Drlg. sh. 9,007 ft.

Hackberry—Cameron Parish

W. T. Burton No. 3 Lewis, sec. 22-12s-10w. R.U.
Daryl Davis No. 1 Doiron, sec. 37-12s-10w. S.D. 40 ft.; abd. loc.
F. J. LeBlanc No. 1 Doiron, sec. 36-12s-10w. Top salt 3,820 ft.; S.D. 4,003 ft. P.B. 3,800 ft.; W.O.C.
Stanolind O. & G. Co. No. 8 Carter & Sweeney, sec. 22-12s-10w. R.U.
Stanolind O. & G. Co. No. 10 Carter & Sweeney, sec. 22-12s-10w. R.U.; (cor.).
Stanolind O. & G. Co. No. 8 Duhon, sec. 22-12s-10w. T.D. 3,290 ft.; 7-in. csg. 3,229 ft.
Superior Oil Co. No. 1 Benson-Vincent, sec. 30-12s-10w. Drlg. sh. 951 ft.
Texas Co. No. 24-B State, sec. 12s-9w. Drk.
Union Sulphur Co. No. 1 Doiron, sec. 37-12s-10w. T.D. 4,888 ft.; 7-in. csg. 4,876 ft.; heaving sh. 5,940 ft.; S.D.
York Oil Field Supply No. 3 Vincent, sec. 28-12s-10w. T.D. 2,947 ft.; P.B. 2,895 ft.; P.B. 2,848 ft.; to sdtrk.; drlg. sh. 2,950 ft.

Horseshoe Bayou—St. Mary Parish

Texas Co. No. 1 St. Mary Parish Ld. Co., sec. 37-17s-9e. 13⅜-in. csg. 1,837 ft.; drlg. sh. 7,006 ft.

Jeanerette—St. Mary Parish

Herton Oil Co. No. 2 Carter, sec. 38-13s-9e. T.D. 9,939 ft.; 7-in. csg. 9,937 ft.; W.O.C.
Herton Oil Co. No. 1 Teche Sugar Co., sec. 58-13s-8e. 7-in. csg. 9,884 ft.; cg. sh. 11,525 ft.

Jennings—Acadia Parish

H. Fostiades et al No. 1 Washington-Opelousas, sec. 41-9s-2w. T.D. 6,890 ft.; well blew out; D.S. stk.; abd.
Fred I. Getty No. 1 Jennings fee, sec. 46-9s-2w. T.D. 1,871 ft.; 6⅝-in. csg. 1,591 ft.; T.D. 2,057 ft.; stuck screen. fsg.
Gulf Ref. Co. No. 39 Arnaudit, sec. 47-9s-2w. T.D. 4,840 ft.; P.B. 2,585 ft.; T.D. 4,586 ft.; 9⅝-in. csg. 4,578 ft.; drlg. sh. 4,778 ft.
Jolly Pet. Co. No. 2 McFarlain, sec. 41-9s-2w. R.U.
Shell Pet. Corp. No. 3 Community, sec. 40-9s-2w. T.D. 7,492 ft.; fsg.; P.B. 7,032 ft.; flwg. small amt. of oil through 10/64-in. ck.
Stanolind O. & G. Co. No. 19 Houssiere-Latrelle, sec. 47-9s-2w. T.D. 6,448 ft.; P.B. 6,135 ft. to strtn. hole; T.D. 6,979 ft.; P.B. 6,700 ft.; W.O.C.
Superior Oil Co. No. 1 Julis Clement, sec. 46-9s-2w. T.D. 7,324 ft.; D.S. stuck; P. B. to sdtrk.; oil sd. 7,028-88 ft.; drlg. sd.&sh. 6,526 ft.
Superior Oil Co. No. 3 Iowa-Jennings, sec. 41-9s-2w. Drlg. sh. 6,736 ft.
Superior Oil Co. No. 6 Jennings-Heywood, sec. 41-9s-2w. Drlg. sh. 5,321 ft.
Superior Oil Co. No. 9 Leckelt, sec. 42-9s-2w. T.D. 7,480 ft.; P.B. 5,302 ft.; drlg. sh. 6,100 ft.
Superior Oil Co. No. 11 Leckelt, sec. 42-9s-2w. Drlg. sd.&sh. 3,402 ft.
Victor Weisse No. 1 Clement, sec. 46-9s-2w. Top salt 3,819 ft.; S.D. 3,938 ft. D.S. stk.; drlg. sdy. sh. 2,811 ft.

Lafitte—Jefferson Parish

Texas Co. No. 9 Lafitte, sec. 20-17s-24e Top oil sd. 10,020 ft.; T.D. 10,055 ft.; 7-in. csg. 10,035 ft.; I.P. 1,318 B.P.D.; ⅜-in. ck.; T.P. 1,500 lbs.
Texas Co. No. 1 Marrero Land & Investment Co., sec. 20-17s-24e. 13⅜-in. csg. 1,937 ft.; T.D. 10,275 ft.; 7-in. csg. 9,700 ft.
Texas Co. No. 2 Marrero Ld. & Inv. Co., sec. 21-17s-24e. Drlg. sdy. sh. 9,031 ft.

Lake Hermitage—Plaquemines Parish

Gulf Ref. Co. No. 7 Lafourche, sec. 12-18s-25e. 7-in. csg. 8,074 ft.; T.D. 9,786 ft.; sdtrkd. hole; T.D. 9,770 ft.; perf. csg. 9,275-85 ft.; tstd. dry; drlg. mud; S.D.

Lake Long—Lafourche Parish

Fohs Oil Co. No. 2 State, sec. 65-17s-19e. R.U.
Fohs Oil Co. No. 3 State, sec. 65-17s-19e. 10¾-in. csg. 2,743 ft.; T.D. 9,539 ft.; sd. 9,517-33 ft.; P.B. 9,464 ft.; perf. csg. 9,482 ft.; T.D. 11,347 ft.; P.B. 9,413 ft.; perf. csg. 9,376-82 ft.; I.P. 416 B.P.D.; 12/64-in. ck.; T.P. 1,250 lbs.; C.P. 400 lbs.

Lake Pelto—Terrebonne Parish

Texas Co. No. 20 State, sec. 8-23s-18e. Drlg. sd. 6,410 ft.

Leesville—Plaquemines Parish

Texas Co. No. 63 Leesville, sec. 27-12s-22e. T.D. 5,695 ft.; 9⅝-in. csg. 5,575 ft.; I.P. 950 B.P.D.; ⅝-in. ck.

Lirette—Terrebonne Parish

Humble O. & R. Co. No. 1 Frank Wurzlow, sec. 6-19s-19e. 13⅜-in. csg. 2,796 ft., cored sd. and sh. show. oil 8,215-25 ft.; drlg. sdy. sh. 11,302 ft.

New Iberia—Iberia Parish

Wm. Helis No. 5 Bolivar, sec. 56-12s-7e. Drlg. anhy. 3,837 ft.; no report.
Wm. Helis No. 4 Gulf Land, sec. 52-12s-7e. T.D. 4,798 ft.; 7-in. csg. 4,798 ft.; I.P. 400 B.P.D.; ⅞-in. ck.
Texas Co. No. 10-B Hanzen, sec. 54-12s-7e. Drlg. sdy. sh. 4,404 ft.

North Crowley—Acadia Parish

Humble O. & R. Co. No. 1 Daly, sec. 44-8s-1e. T.D. 9,083 ft.; abd.
Humble O. & R. Co. No. 2 Federal Ld. Bk., sec. 34-8s-1e. Drlg. sdy. sh. 7,825 ft.
Humble O. & R. Co. No. 1 Graham, sec. 3-9s-1e. R.U.
Humble O. & R. Co. No. 2 Habetz, sec. 45-8s-1e. Drk.

Quarantine Bay—Plaquemines Parish

Gulf Ref. Co. No. 4 State, sec. 17-19s-17e. Drlg. sh. 2,612 ft.

Roanoke—Jeff Davis Parish

Humble O. & R. Co. No. 10-B Devilbiss, sec. 11-9s-4w. T.D. 8,850 ft.; 7-in. csg. 8,850 ft.

Sorrento—Ascension Parish

Sorrento Oil Co. No. 1 L. L. Barnard et al, sec. 18-10s-4e. 10¾-in. csg. 1,070 ft drlg. sh. 3,810 ft.

South Elton—Jeff Davis Parish

Stanolind O. & G. Co.-Amerada Pet. Corp. No. 3-B Calcasieu Natl. Bank, sec. 27-7s-3w. T.D. 9,154 ft.; conditioning hole; 9⅝-in. csg. 8,647 ft.; drlg. sh. 9,641 ft.

Starks—Calcasieu Parish

Capital Oil Co. No. 1 Lutcher-Moore, sec. 24-9s-13w. R.U.

Sulphur—Calcasieu Parish

Union Sulphur Co. No. 852 fee, sec. 29-9s-10w. T.D. 5,068 ft.; P.B. and sdtrkd.; T.D. 5,193 ft.; salt; P.B. 1,703 ft.; drlg. sh. 1,916 ft.
Union Sulphur Co. No. 858 fee, sec. 29-9s-10w. Drlg. sdy. sh. 4,736 ft.

Valentine—Lafourche Parish

Wm. Helis No. 1 Valentine-Sugars, Inc., sec. 2-17s-20e. R.U.
Pan American Prod. Co. No. 1-B Community, sec. 58-17s-20e. Drlg. sh. 6,480 ft.
Pan American Prod. Co. No. 1 Harang, sec. 9-17s-20e. Spd.
Pan American Prod. Co. No. 16 Harang, sec. 7-17s-20e. Drlg. sh.&L. 7,086 ft.

Venice—Plaquemines Parish

Tide Water Oil Co. No. 5 Manhattan Fruit Co., sec. 26-26s-30e. Top oil sd. 7,250 ft.; T.D. 7,300 ft.; P.B. 4,800 ft.; W. O.C.
Tide Water Asso. Oil Co. No. 6 Manhattan Ld. & Fruit Co., sec. 26-21s-30e. Drlg. sh. 1,110 ft.

Vinton—Calcasieu Parish

M. McLean No. 17 Gray, sec. 35-10s-12w. R.U.
J. V. Redick No. 1 Vincent, sec. 34-10s-12w. T.D. 2,312 ft., oil sd.; 7-in. csg. 2,285 ft.; bailing; drld. out 2,498 ft.; pmpg. 125 bbls. fluid, 25% S.W.
Sutton-Burton No. 1 Calcasieu Natl. Bk., sec. 3-11s-12w. T.D. 4,500 ft.; S.D.

Villa Platte—Evangeline Parish

Continental Oil Co. No. 1 N. H. Hirsch, sec. 44-3s-2e. Drlg. sh. 6,100 ft.
Continental Oil Co. No. 1 La. Ld. Improvement Co., sec. 46-3s-2e. 18⅝-in. csg. 247 ft.; top Cook Mtn. 7,997 ft.; top oil sd. 9,017 ft.; T.D. 9,085 ft.; 7-in. csg. 9,040 ft.; I.P. 430 B.P.D.; 4/64-in. ck.
Continental Oil Co. No. 1 McDaniels, sec. 44-3s-2e. R.U.
Continental Oil Co. No. 1 Tate, sec. 44-3s-2e. R.U.

Welsh—Jeff Davis Parish

Howard Clayton No. 1 Walshe, sec. 21-9s-5w. Oil show 1,030-31 ft.; T.D. 1,215 ft.; bailed dry; R.U. to pmp.
Stanolind O. & G. Co. No. 1 W. B. Conover, sec. 20-9s-5w. 13⅜-in. csg. 2,017 ft.; drlg. sh.&L. 4,445 ft.

White Castle—Iberville Parish

Shell Pet. Corp. No. 6 Shingle. Drlg. sh. 5,368 ft.

Woodlawn—Jeff Davis County

Union Sulphur Co. No. 2 Calcasieu Natl. Bk., sec. 12-9s-6w. R.U.

S. LOUISIANA WILDCATS

Acadia Parish

H. E. Dalton No. 1 Setting, sec. 17-7s-1w. T.D. 5,106 ft.; P.B. to approx. 500 ft.; T.D. 3,925 ft.; D.S. stuck.
Humble O. & R. Co. No. 1 Finch, sec. 22-10s-1e. T.D. 8,056 ft.; fsg. for bit.

Calcasieu Parish

Republic Prod. Co. No. 1 Sabine Tram. Co., sec. 25-18s-14w. 10¾-in. csg. 1,981 ft.; T.D. 9,620 ft.; hole clean; S.D.; high wtr.
Shell Pet. Corp. No. 1 Calcasieu Natl. Bk., sec. 18-11s-10w. Cg. sh. 8,246 ft.
Sun Oil Co. No. 1 Lutcher-Moore Lbr. Co., sec. 1-8s-13w. R.U.
Wheeler Oil Corp. No. 2 Sch. Ld., sec. 16-9s-7w. 15½-in. csg. 46 ft.; drlg. sh. 641 ft.

Cameron Parish

Humble O. & R. Co. No. 1-B Miami Corp., sec. 7-14s-6w. 13⅜-in. csg. 2,150 ft.; W.O.C.

Cameron Parish—Gulf of Mexico

Superior Oil Prod. Co. et al No. 1 State-Gulf of Mexico, 3,800 ft. W, 6,200 ft. S of SE cor. of irregular sec. 4-15s-8w. 10¾-in. csg. 1,157 ft.; 7⅝-in. csg. 7,166 ft.; T.D. 9,394 ft., sd.; well attempted to blow out; killed; D.S. stk. 8,800 ft.; fsg. 6,540 ft.

East Baton Rouge Parish

Cavalier Oil Co. No. 1 Elliott, sec. 3-9s-2e. T.D. 7,678 ft.; S.D.
Austin B. Taylor No. 1 Duplantier, sec. 65-7s-1w. R.U.

Iberia Parish

Texas Co. No. 1 Bayless-Jones, sec. 58-12s-5e. Drlg. 408 ft.
Texas Co. No. 2-B Vermilion Bay, sec. 20-16s-5e. T.D. 9,101 ft.; P.B. and sdtrkd. at 5,788 ft.; T.D. 7,020 ft.; P.B. 6,385 ft.; to sdtrk.; T.D. 6,600 ft.; sdtrkd. 5,730 ft.; drlg. sd. 5,891 ft.

Lafayette Parish

Continental Oil Co. No. 1 Foreman, sec. 36-9s-3e. Drlg. sh. 2,730 ft.

Pointe Coupe Parish

Batchelor Oil Co. No. 1 Hackney, sec. 28-3s-8e. 20-in. csg. 117 ft.

St. James Parish

Continental Oil Co. No. 1 Realty Operators, sec. 17-12s-17e. R.U.

St. Martin Parish

Carter & Stewart No. 2 Martin, sec. 32-9s-7e. Drlg. sd. 4,271 ft.
Shell Pet. Corp. No. 1 Unit, sec. 11-14s-12e. Cg. sh. 8,393 ft.

Texas Co. No. 4 State Lake Mongoulois, sec. 14-10s-9e. Drlg. S.W. sd. 7,445 ft.

St. Mary Parish

Pet. Heat & Power Co. No. 9, sec. 9-13s-9e. Drlg. sh. 1,842 ft.

Terrebonne Parish

Fohs Oil Co. No. 1 Buckley & Bourg, sec. 77-19s-17e. T.D. 2,090 ft.; fsg.
Fohs Oil Co. No. 1 State, sec. 41-19s-19e. 18⅝-in. csg. 246 ft.

ARKANSAS

Cleveland County

J. T. Markwick and E. O. Olds No. 1 A. Vance, NW cor. NW sec. 18-11-11. Drlg. 80 ft.

Columbia County

Kerr-Lynn Oil Co. No. 1 Barnett, sec. 14 17-20. Cd. hd. slightly porous L. 7,659-64 ft.; T.D. 6,664 ft.; set 7-in. csg. 7,-052 ft.; M.I. 3-in. D.S.
Standard Oil Co. of La. No. 1 Bodcaw-Barbara, NE cor. SE NW sec. 18-16-22. Drlg. sh. 4,944 ft.
Standard Oil Co. of La. No. 1 S. T. Crone, NW cor. NW SE sec. 8-16-22. Drlg. L. 3,427 ft.
Standard Oil Co. of La. No. 1 W. P. Phillips et al, 660 ft. N and W, C sec. 15-17-19. R.U.

Crittendon County

Manning & Martin No. 1 Cartwright, SW cor. sec. 16-7n-8e. S.D. 4,200 ft.

LaFayette County

Lillian Taubel et al No. 1 Tatum, NE cor. SE NW sec. 18-16-22. Drlg. sh.& L. 6,336 ft.

Little River County

Heenan & Coe No. 1 Waldrop, SE NW sec. 21-12-28. S.D. 1,960 ft.
Joe G. Strahan et al No. 2 Dierks Lbr. Co. S.D. for D.S. 2,260 ft.

Lonoke County

Frank F. Silver No. 2 Chambers, N½ SW NE sec. 17-2n-7w. D.&A.; T.D. 1,-500 ft.

Miller County—Rodessa

G. C. Grasty No. 1 Mitchell, NW sec. 11-20-28. Drlg. sh. 3,220 ft.
Gulf Oil Corp. No. 1 Hanner, SE cor. sec. 16-20-24. Drlg. sh. 4,779 ft.
R. Lacy No. 2 Grogan, E½ W½ sec. 15-20-28. Drlg. 2,100 ft.
W. M. Layton No. 1 McKellar, SE cor. W½ W½ sec. 15-20-28. Set 9⅝-in. csg. 2,037 ft.; drlg. 3,550 ft.
R. H. Long No. 3 Greer, NE SE sec. 10-20-28. Set 9⅝-in. csg. 2,030 ft.; drlg. L. 6,030 ft.
McClanahan & Feazel No. 2 Eason, C N½ NW SW sec. 12-20-28. Drlg. 1,-965 ft.
R. W. Newell No. 1 Thomas, NW SE sec. 12-20-28. Set 5½-in. csg. 6,130 ft.; T.D. 6,144 ft.; W.O.
Nivia Oil Corp. No. 1 Cross, SE cor. SE NE sec. 11-20-28. T.D. 6,106 ft.; set 7-in. csg. 6,104 ft.; perf. 6,040-95 ft.; acid.; W.O.S.R.
Texas Canadian Oil Corp. No. 3 Thomas, NE cor. NW SE sec. 12-20-28. Drlg. sh.&L. 4,080 ft.
Thompson & Jaffra No. 1-A Treadway, NW cor. SE SE NE sec. 10-20-28. Drlg. 5,621 ft.
Sam Tillingsworth No. 1 Treadway, SW cor. SE SE NE sec. 10-20-28. Drlg. 6,-123 ft.

Nevada County

Bruce E. Wallace No. 2 Haynie, SE cor. sec. 5-14-21. S.D. fuel 1,060 ft.

Ouachita County

Copenhaven Oil Corp. No. 1 Evans, NE cor. NE SW sec. 20-11-19. S.D. 1,825 ft.
A. H. Tarver et al No. 1 Guy Smith, sec. 16-14-19. Tokio sd. 2,186-2,210 ft.; T.D. 2,331 ft.; W.O.

Pulaski County

A. L. Kitselman, No. 2 A. L. Kitselman Jr., SE SE SW sec. 2-1s-13e. Drlg. very hd. bl. slate 2,275 ft.

Union County—Shuler

Alice Sydney Oil Co. No. 3 Morgan, NW NE SE sec. 18-18-17. T.D. 7,717 ft.; set 7-in. csg. 7,629 ft.; perf. 7,525-65 ft.; comp.; 1,248 B.P.D.; 24/64-in. ck.
Alice Sydney Oil Co. No. 1 Powledge, SE cor. SW SE sec. O.W.W.O.; old T.D. 6,005 ft.; R.U. to dpn.
Ark. Southern Oil Corp. No. 2-A Simmons, SW cor. NE NW sec. 15-18-13. T.D. 2,307 ft.; O.I.H.; W.O.S.R.
E. M. Jones No. 3 Marine Oil Co., NE NW SE sec. 17-18-17. Drlg.
E. M. Jones et al No. 1-A Murphy Ld. Co. Cg. 7,519 ft.
Lion Oil Ref. Co. No. 2 Marine Oil Co., SW cor. E½ SE¼ sec. 17-18-17. Drlg. 4,872 ft.
Lion Oil Ref. Co. No. 1 Mayfield, SE cor. Lot 3, Fract. NW¼ sec. 18-18-17. Drlg. 5,295 ft.
Lion Oil Ref. Co. No. 1 Miller, SW cor. NE NW sec. 18-18-17. Drlg. red and gr. sh. 529 ft.
Lion Oil Ref. Co. No. 4-A Edna Morgan, NW cor. Lot 1, SW sec. 18-18-17. Drlg. red and gr. sh. 5,720 ft.
Lion Oil Ref. Co. No. 5-B Morgan, SE cor. W½ SE sec. 18-18-17. Drlg. sdy. sh. 6,360 ft.
Lion Oil Ref. Co. No. 2-C D. S. and J. C. Morgan, SW cor. SE SE sec. 18-18-17. Drlg. 2,220 ft.
Lion Oil Ref. Co. No. 5-A E. Morgan, NE cor. Lot 7, SW sec. 18-18-17. Set 10¾-in. csg. 2,300 ft.
Marine Oil Co. No. 4 fee, NW cor. SW SW sec. 17-18-17. Drlg. red and gr. sh. 5,860 ft.
Marine Oil Co. No. 3 Justiss, NE cor Lot 7, NW sec. 18-18-17. Drlg. red and gray sh. 4,956 ft.
Marine Oil Co. No. 4 Justiss, cen. Lot 7 NW sec. 18-18-17. Drlg. sdy. sh. 7,301 ft.
Marine Oil Co. No. 1 Miller, SE cor. Lot 1, NW sec. 18-18-17. Drlg. 925 ft.
Phillips Pet. Co. No. 1 First Natl. Bk NE SW sec. 17-18-17. Set 7-in. csg. 7,-607 ft.; T.D. 7,635 ft.; perf. 7,542-77 ft.; wsg. to test.
Phillips Pet. Co. No. 2 Justiss, NW se 18-18-17. Set 7-in. csg. 7,700 ft.; reperf. 7,542-61 ft.; comp. 971 B.P.D.; 24/64-in. ck.; est 2,000,000 ft. gas.
Phillips Pet. Co. No. 1 Marine Oil Co., NE cor. NW NE sec. 20-18-17. Drlg. red and gr. sh. 5,425 ft.
Phillips Pet. Co. No. 2 Rosen, SE cor. SW NE sec. 18-18-17. Drlg. red and gr. sh. 6,015 ft.
Texas Canadian Oil Corp. No. 1 Powledge, C NE NW NW sec. 21-18-17. Drlg. 2,280 ft.

Union County—Other

Penn-Ark. Pet. Corp. No. 1 Raulston, sec 12-17-14. T.D. 3,175 ft.; S.D.; litigation.
W. D. Wingfield, Tr., No. 1 Kidd Est., C NE NW SE sec. 15-18-13. Set 7-in csg. 2,263 ft.; T.D. 2,322 ft.; sd. 2,310-22 ft.; 300 ft. O.I.H.; comp. 40 B.P.D., pump; 20% S.W.
W. D. Wingfield, Tr. No. 2 Kidd Est., SE cor. NW SW sec. 15-18-13. R.U.

TEXAS

Week Ending February 19

GULF COAST FIELDS

Lockridge—Brazoria County

Gulf Oil Corp. No. 5 Carrie Baker, J. W. Hall Sur. No. 11. Bldg. drk.
Gulf Oil Corp. No. 3 Gibson, J. W. Hall Sur. T.D. 6,366 ft.; run 7-in. csg.
Gulf Oil Corp. No. 3-A G. L. Wood, T. Alsbury Sur. T.D. 6,368 ft.; make drill stem test.
Shell Pet. Corp. No. 4-B Ramsey, J. W. Hall Sur. T.D. 6,369 ft.; 7-in. csg. 6,-565 ft.; I.P. 275 B.P.D.; 11/64-in. choke.

Hastings Field—Brazoria County

C. Andrade No. 1 Blumer, H.T.&B. Sur. No. 28. Drlg. sh. 3,936 ft.
Humble O. & R. Co. No. 10 R. D. Haden. R. Hoppel Sur. Drk.
Humble O. & R. Co. No. 1 Hortsman, H.T.&B. Sur. No. 37. T.D. 6,223 ft.; abd.
Humble O. & R. Co. No. 7 M. G. McDeed, H.T.&B. Sur. No. 30. Drlg. sh. 1,816 ft.
Humble O. & R. Co. No. 6 W. H. Schindler, H.T.&B. Sur. No. 35. R.U.
Stanolind O. & G. Co. No. 7 R. L. Autrey, H.T.&B. Sur. No. 37. 10¾-in. csg. 1,236 ft.
Stanolind O & G. Co. No. 10 F. N. Brown, H.T.&B. No. 29. Drk.
Stanolind O. & G. Co. No. 8 T. C. Edwards, Wm. Henry Sur. R.U.
Stanolind O. & G. Co. No. 6 Matsushita, H. Stevens Sur. R.U.
Stanolind O. & G. Co. No. 16 L. D. Shaw, H.T.&B. Sur. No. 36. Drlg. sh. & shells 2,530 ft.
Stanolind O. & G. Co. No. 2 G. Sheffield, H.T.&B. Sur. 10¾-in. csg. 1,236 ft.
Stanolind O. & G. Co. No. 3 H. M. Shyrock, H.T.&B. Sur. No. 29. Drlg. sh. and L. 3,844 ft.
Stanolind O. & G. Co. No. 2 Velma Stockwell, H. Stevens Sur. Drk.
Stanolind O. & G. Co. No. 7 W. B. Wooster, A.C.H.&B. Sur. No. 1. Drlg. L. and sh. 5,648 ft.

Old Ocean—Brazoria County

Harrison & Abercrombie No. 5 Bernard, C. Breen Sur. 9⅝-in. csg. 7,000 ft.
Harrison & Abercrombie No. 1 Osberne, C. Breen Sur. Drlg. sh. 6,567 ft.
Harrison & Abercrombie Oil Co. No. 1 Troyer and West Texas Abst. Co., C. Breen Sur. Drlg. sh. 5,467 ft.

Sandy Point—Brazoria County

Stanolind O. & G. Co. No. 3 J. A. Fite, D. Talley Sur. 9⅝-in. csg. 1,027 ft.; T.D. 6,500 ft., oil and gas sand; running Schlumberger sur.

West Columbia—Brazoria County

Frost and Dunnan No. 1 E. S. Parker, Geo. Tennille Sur. Bldg. drk.
Mike Hogg No. 1 Varner, M. Varner Sur. Drlg. sh. 1,175 ft., (no report).
Sterling Oil & Ref. Co. No. 1 Powers et al, Geo. Tennille Sur. Drlg. sh. 5,876 ft.
Texas Co. No. 2 Goldman, G. Tennille Sur. Drk.
Texas Co. No. 1 T. Robinson, George Tennille Sur. T.D. 5,385 ft.; P.B. and strkd.; drlg. sh. 5,390 ft.
Texas Co. No. 4 T. L. Smith, Geo. Tennille Sur. Drlg. sh. and L. 3,367 ft.
Wallace Oil Co. and others No. 1 Hargrove, G. Tennille Sur. Drk.

Calhoun—Heyser—Victoria County

Blanco Oil Co.-Buchannan No. 8 C. S. Dunwoody, R.U.
Geo. Echols No. 8 W. H. Bennett, J. E. Galban Sur. Drk.
Geo. Echols No. 4 Lander, J. Galban Sur. Core 5,712 ft.
George Echols No. 5 O. M. Lander, J. E. Galban Sur. Drk.
Gulf Oil Corp. No. 2 R. R. Bonner, J. E. Galban Sur. Drlg. 600 ft.
Gulf Oil Corp. No. 3-B T. P. Traylor, J. E. Galban Sur. Drlg. sh. 3,612 ft.
Magnolia Pet. Co. No. 6 O. M. Lander, J. E. Galban Sur. Drlg. sh. 4,786 ft.
Sun Oil Co. No. 7 W. N. Coffey, G. E. Galban Sur. Spudded.

Seabreeze—Chambers County

Sun Oil Co. No. 1 R. J. Barrow, A. Yarbo Sur. R.U.
Sun Oil Co. No. 1 Seabreeze Ld. Co., H.T.&B. Sur. 102. 10¾-in. csg. 1,948 ft. drlg. sh. 9,750 ft.
Sun Oil Co. No. 1 J. T. White, sec. 118, H.T.&B. Sur. Cor. sh. 5,058 ft.

Silsbee—Hardin County

Humble O. & R. Co. No. 1 B. L. Kirkendall, NE offset to No. 1 Howell. Loc.

Clinton—Harris County

Stanolind O. & G. Co. No. 1 Nora Barraco, Reels & Troubough Sur. Drlg. sh. and L. 2,276 ft.

Eureka—Harris County

Jack Frazier No. 1 Bollmer & Neimann, J. Reinerman Sur. R.U.

Fairbanks—Harris County

Amerada-Stanolind O. & G. Co. No. 1 Maggie L. Peters, W. K. Hamblin Sur., Abst. 317. 10¾-in. csg. 1,197 ft.; T.D. 6,894 ft.; 7-in. csg. on bottom.
E. L. Smith and H. B. Ownby Drlg. Co. Geo. Eyers Sur. 10¾-in. csg. 1,182 ft.
H. E. Williams No. 1 A. Vega, G. Williams Sur. R.U.

Friendswood—Harris County

Amerada Pet. Corp. & Stanolind O. & G. Co. No. 1 E. M. White, J. Clarkson Sur. Bldg. drk.
H. C. Cockburn et al No. 1 H. C. Cockburn, Wm. K. Smith Sur. Drlg. sh. 4,337 ft.
Humble O. & R. Co. No. 5 Scott Beamer, T. Choate Sur. Drlg. sh. 4,209 ft.
Humble O. & R. Co. No. 1 J. L. Jones and E. A. Gray, Perry and Austin Sur. Drlg. sh. 5,020 ft.
Humble O. & R. Co. No. 3 Keisling, T. Choate Sur. Drlg. sh. 2,490 ft.
Humble O. & R. Co. No. 1 Robt. Perry and Austin Sur. Drlg. sh. & L. 4,145 ft.
Humble O. & R. Co. No. 2 J. J. Settegas, Perry and Austin Sur. Drlg. sh. 2,653 ft.
Humble O. & R. Co. No. 1 E. E. Watson. Drk.

Hitchcock—Galveston County

N. W. Hunter No. 2 M. Stewart, J. Spillman Sur. T.D. 5,250 ft.; P.B. 1,500 ft.; prep. to sidetrack.

LaBelle—Jefferson County

Sun Oil Co. No. 3 Broussard-Hebert, B. Blackman Sur. R.U.

North Cheek—Jefferson County

Magnolia Pet. Co. No. 3-A Phelan, S. Stevers Sur. Crooked hole; drlg. sh. 8,215 ft.

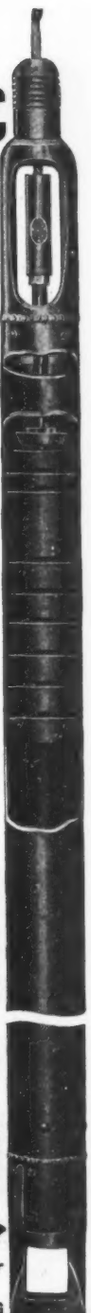
Hardin—Liberty County

Ark. Fuel Oil Co. No. 1 W. J. Green, A. B. Hardin Sur. Spudded.
Atlantic Ref. Co. No. 1 J. V. Cessna, H. B. Johnston Sur. T.D. 7,600 ft.; rng. csg.
Atlantic Ref. Co. No. 2 W. McMurtry, H. B. Johnson Sur. Spd.
Jack Frazier No. 1 Buffam-Benning, J. Robeson Sur. R.U.
Jack Frazier No. 1 W. McMurtry, H. B. Johnson Sur. T.D. 7,794 ft.; recvd. oil perf. csg. 7,610-18 ft.; comp., no gauge.
Gulf Oil Corp. No. 1 J. C. Barfield, H. B. Johnson Sur. R.U.
Gulf Oil Corp. No. 1 J. H. Cessna, H. B. Johnson Sur. Coring 7,610 ft.
Gulf Oil Corp. No. 1 M. F. Tullos, H. B. Johnston Sur. Loc.
Halliburton Oil Prod. Co. No. 1 Hanchey, H. B. Johnson Sur. Spudded.
Humble O. & R. Co. No. 1 W. McMurtry, H. B. Johnson Sur. Drlg. sh. 1,926 ft.
Humble O. & R. Co. No. 1 Partlow, H. B. Johnson Sur. T.D. 7,645 ft.; 5-in. csg. 7,628 ft.; flowing oil and salt water; testing.
McAlester Fuel Oil Co. No. 2 V. B. Hinson, H. B. Johnson Sur. Coring 7,557 ft.

MILLER

Oil Companies throughout the world find it almost unbelievable, the way production increases after cleaning-out with a MILLER Sand Pump.

The MILLER is made in diameters of 2½, 3, 3½, 4, 4¼, 5, 5½, 7 and 9 inches and lengths of 20, 25 and 30 feet. 5/32-inch wall thickness in REGULAR Type, ¼-inch wall tubes HEAVY Type Sand Pumps.



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- **STAR BOTTOM** — Used for cutting the sand loose.
- **CHISEL BOTTOM** (In Pump) — With this bottom tightly packed sand can be easily broken in small pieces so it can be picked up in the pump.

Write for Descriptive Folder and Price List

See Page 1186 COMPOSITE CATALOG

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FOR SALE BY SUPPLY STORES EVERYWHERE

Sun Oil Co. No. 1 A. A. Hisey, H. B. Johnston Sur. Drlg. sh. 150 ft.
L. W. Wickes No. 2 Tullos, H. B. Johnston Sur. Spudded.

Bay City—Matagorda County

Hamman Explo. Co. No. 2 Thompson, E. Hall Sur. Top sand 9,660 ft.; coring sand 10,011 ft.
Pan American Prod. Co. No. 1 Richers, I.&G.N. Sur. X-3. Coring sh. 8,629 ft.

Buckeye—Matagorda County

United North & South Development Co. No. 1 G.B.M., Cotton Lge. 7-in. csg. 8,667 ft.; T.D. 10,500 ft.; hole cleaned; W.O.O.; P.B. to 7,300 ft.; to sdtrk.; T.D. 7,910 ft.; testing.

Palacios—Matagorda County

Atlantic Ref. Co. & McCarthy No. 3 Foley Ld. Co., L. Goodwin Sur. 7-in. csg. 8,635 ft.; drlg. plug.

Call—Newton County

Houston Oil Co.-Republic Prod. Co. No. 3 Sabine Tram, H.&T.C. Sur. No. 37. R.U.

Orange—Orange County

J. M. Campbell No. 1 Scales, Wm. Dyson Sur. Drlg. 1,120 ft.
Gulf Oil Corp. No. 1 Cora Granger, Wm. Dyson Sur. 10¾-in. csg. 1,637 ft.; drlg. sh. 5,367 ft.
Gulf Oil Corp. No. 1 Granger Wm. Dyson Sur. T.D. 5,951 ft.; run 7-in. csg.
Ryan and Thompson No. 1 Norwood, Wm. Dyson Sur. T.D. 6,355 ft.; run Schlumberger.
Union Prod. Co. No. 2 Lutcher-Moore, Dyson Sur. 9⅝-in. csg. 5,162 ft.

Segno—Polk County

Gulf Oil Corp. No. 2 Ragan, I.&G.N. Sur. 15. Drlg. sh. 6,655 ft.
Gulf Oil Corp. No. 10 G. F. Wing, I.&G. N. Sur., sec. 15. Drlg. sh. 3,715 ft.

Spurger—Tyler County

Republic Prod. Co.-Houston Oil Co. No. 8 Hurd, N. Hurd Sur. 10¾-in. csg. 2,300 ft.

GULF COAST WILDCATS

Brazoria County

W. H. Christie et al No. 1 J. J. Settegast, F. Green Sur. Derrick.
Albert Plummer No. 1 G. C. Street, H. M. Hunter Sur. R.U.
Pure Oil Co. No. 1 Clemons State Farm S. F. Austin 7⅛ Lge. 7⅝-in. csg. 1,955 ft.
Pure Oil Co. No. 1 Smith, S. F. Austin Sur. 9⅝-in. csg. 7,734 ft.; T.D. 9,830 ft.; heaving sh.; reaming.
Texas Co. No. 4 Freeport Sulphur Co., C Arriola Sur. 10-in. csg. 1,214 ft.; T.D. 3,900 ft.; P.B. 2,564 ft.; sdtrkd.; T.D. 3,000 ft.; P.B. to sdtrk.; cd. sd. oil odor 3,539-48 ft.; T.D. 3,894 ft.; P.B. drlg. sd. 3,130 ft.

Chambers County

A. A. Cameron et al No. 1 White, Solmon Brill Sur. R.U.
Leverne Decker et al No. 1 Broussard Trust, sec. 30, H.T.&C. Sur. R.U.
Standard Oil Co. of Texas and Salt Dome Oil Corp. No. 1 State, Galveston Bay. T.D. 6,030 ft.; 7-in. csg. 5,955 ft.; tstg. I.P. 642 bbls. per day, ¼-in. choke.

Harris County

W. S. Howell No. 1 Root, A. McCormick Sur. S.D. 2,807 ft.
Humble O. & R. Co. No. 11 Rohlfs, John Sellers Sur. T.D. 8,116 ft.; fsg.
H. J. Porter No. 1 J. W. Faust, Peter White Sur. T.D. 431 ft.; W.O.C.

Jackson County

Magnolia Pet. Co. No. 1 West Ranch, R Musquez Sur. T.D. 6,494 ft.

Jefferson County

I. E. Harwell No. 1 State, Gulf of Mexico. S.D. 4,050 ft.
Humble O. & R. Co. No. 1 State, Gulf of Mexico, sec. No. 8. Derrick.

Matagorda County

Pierce Estate No. 1 Pierce, I.&G.N. Sur. No. 7. T.D. 6,624 ft.; swabbing 70 per cent oil, 30 per cent S.W.
Pierce Est. et al No. 1 Paul Kruger, Nel. C. Warren Sur. Drlg. sh. 9,750 ft.
Sun Oil Co. No. 1 Fred Robbins, C. H. Vandeveer Sur. Drlg. sh. 9,731 ft.

Polk County

C. E. Gates No. 2 I. O. Jackson, J. W. Abbey Sur. Spd.

S. W. TEXAS WILDCATS

Atascosa County

L. W. Steiren No. 1 Crawford, 4 mi. W of Anchorage. T.D. 3,880 ft.; prep. to P.B. and test Austin chalk; P.B. 3,680 ft.; swbd.; lnr. collapsed; to reset; abd.

Bastrop County

J. W. Bibb No. 1 Lentz, F. Wilkenson Sur. Top Austin Chalk with odor of oil 2,530 ft.; T.D. 2,514 ft.; 5½-in. csg. 2,443 ft. tstg.; showing some oil; S.D.
R. C. Franklin No. 2 Yarrington, Jose Manuel Bangs Sur. Drk.

Bee County

Dirks Bros. No. 1 Mangus Beck, sec. 17, Chittim Miller Ranch Subd. T.D. 4,273 ft.; perf. csg. 4,215-23 ft.; I.P. 60 bbls. of oil per day through 5/32-in. ck. with 300 lbs. W.P. on tbg. and 625 lbs. C.P.
H. E. Pressy No. 1 F. H. Pressy, C. Williams Sur. Drlg. sh. 1,210 ft.

Bexar County

Hamill & Hamill No. 1 Brietzke, Marie Jose Rodriguez Sur. Drlg. sh. 825 ft.
Hilkok & Reynolds No. 1 Elvert, Thomas York Sur. T.D. 1,670 ft.; run csg.
Joe H. Noake No. 1 Oppenheimer, W. Miller Sur. No. 180. Drk.
Chas. Persyn No. 1 fee, Wm. Lindsey Sur. Drlg. chlk. 1,382 ft.

Caldwell County

D. L. Byrd No. 1 Parr, Jas. Hinds Sur., Abst. 125. S.D. 1,036 ft.
Mac-Wag-Tree Oil Co. No. 1 Roberts, W House Sur. 5½-in. csg. 2,517 ft.; T.D. 2,713 ft.; shows oil; run tbg. to test.

Cameron County

Saxet Prod. Co. No. 1 Port Isabel Irrig. Co. Sur. 30. Drk.

Dimmitt County

Texas & Maryland Corp. No. 1 McKnight, Blk. 13, sec. 23, Base of Austin Chalk 5,201 ft.; top Georgetown L. 6,120 ft.; T.D. 7,116 ft.; prep. for D.S.T.

Duval County

Cown & Sorey No. 1 Taylor, J. Poitevent Sur. 214. T.D. 1,467 ft.; hole bridged.
J. K. Culton No. 1 Sutherland, J. B. Duncan Sur. R.U.
Adolph Devore No. 1 E. R. Hagist, Sur. 265 ft.; T.D. 1,748 ft.; fsg.
Gillespie & Sons No. 1 Hamilton, J. Poitevent Sur. No. 85. 10¾-in. csg. 101 ft.; T.D. 4,030 ft.; abd.
Frank Gravis No. 1 Megargal, J. Boyles Sur. R.U.
Magnolia Pet. Co. No. 1 Duval County Ranch Co., Sur. No. 195. 10¾-in. csg. 83 ft.; drlg. sh. 2,160 ft.
Magnolia Pet. Co. No. 1 A. Lopez, M Lopez Sur. No. 82. T.D. 6,948 ft.; abd.
Southwood Oil Co. No. 1 Nolen, P. Cabello Sur. and F. Thompson Sur. No. 106. T.D. 6,258 ft.; abd.
Trinity Drillers No. 1 Peters, C.C.S.D. Sur. 66. Drlg. sh. 2,376 ft.; no report.

Edwards County

Amon G. Carter No. 1 Sweeten, SE¼ Blk. 2, Sur. 49. 9-in. csg. 5,030 ft.; T.D. 6,507 ft.; abd.
Dan Auld No. 1 Henderson, sec. 46, Blk. E. 7-in. csg. 1,865 ft.; S.D. 3,190 ft.

Goliad County

Windward Oil Co. No. 1 Dreier, B.S.&F. Sur. No. 7. 10-in. csg. 1,000 ft.

Guadalupe County

E. A. Hearn et al No. 1 Dudelof, Jas. D. Clements Sur. S.D. 720 ft.
Kreiger & Douglass No. 1 Oliver, R. Smith Sur. T.D. 2,401 ft.; abd.
Riddle Oil Co. No. 1 Weber, Guadalupe Torres Sur. T.D. 400 ft.; fsg.

Jim Hogg County

W. L. Stephens et al No. 1 Grey, Simon De Hinojosa Gr. 10-in. csg. 41 ft.; S.D. 3,150 ft.

Jim Wells County

H. M. Hill et al No. 1 Kuether, Lots 70 and 75, sec. 52, Haldeman Subd. S.D. 3,342 ft.
H. H. Howell et al No. 1 Goldapp, Jose Maria Garcia Sur. T.D. 3,644 ft.; 5½-in. csg. 3,602 ft.; tstg.
Magnolia Pet. Co. No. 8 Seeligson, A. Rameriz Sur. 13⅜-in. csg. 1,206 ft.; drlg. sh. 5,298 ft.
Homer Presnall et al No. 1 Banker Mortgage Co., Jose Maria Garcia Sur. R.U.
Rowan & Hope No. 1 Robert Adams, T.&N.O. Sur. No. 19. 13⅜-in. csg. 1,155 ft.; drlg. sh. 5,459 ft.

Karnes County

Randon Oil Co. No. 1 Radford, M. T. Carolos Martinez Sur. Drlg. sh. 3,426 ft.

Kleberg County

Magnolia Pet. Co. No. 1 Dietz, Gabriel Trevino Sur. 13⅜-in. csg. 1,220 ft.; T.D. 7,500 ft.; abd.
Pure Oil Co. et al No. 1 State Ld., Tr. 68, Laguna Madre Bay, Lse. No. 528. Dredging canal.

Lasalle County

Ralph B. Reed No. 1 Yeager, Blk. 7, Sec 8, Wallace Subd., Yeager ranch. T.D. 1,620 ft.; abd.

Lee County

Jas. E. Pederson No. 1 Turner, David Hudson Sur. S.O.&G. 6,140-80 ft.; sdtrkd. at 4,600 ft. and drld. to 6,132 ft.; S.O.&G.; set csg. 6,021 ft.; acdzg. with 20-bbl. load; when opened well flwd 20-bbl. head and went dead; swbd. oil and wtr.; acd.; pulling tbg. to rework and wtr.; acd.; S.D.
Eleoussa Oil Co. No. 1 Sanders, J. Vin Roeder Sur. S.D. 3,995 ft.

Live Oak County

James Chew No. 1 Alma McNeil, Alexander Parks Sur. T.D. 5,076 ft.; 7-in. 5,076 ft.; swbd. dry, with small amt. of gas.
Louis Franklin No. 1 Russell, John Hefferman Sur. R.U.
Harvey & Henderson No. 1 Nichols, Thos. Henry Sur. T.D. 1,751 ft.; abd.
Holland Oil Co. No. 2 Alamo Lbr. Co., Josefa Gemenez Sur. Drlg. sh. 1,436 ft.
Karotkin & Richardson No. 1 Pape, Wm. R. Conner Sur. R.U.
Loma Oil Co. No. 2-B Reagan, Wm. Hely Sur. T.D. 1,200 ft.; abd.
Ray L. Martin No. 1 Adams, J. Buchannan Sur. Drlg. sh. 780 ft.
J. I. Newton No. 1 George West Est., Airy Pieratt Sur. No. 129. Spd.
Parr & Delaney No. 1 Hogan & Stewart, A.B.&M. Sur. 45. Drlg. sh. 2,027 ft.
J. P. Payzor No. 1 San Antonio Joint Stock, J. J. Roberts No. 1 Mahone. Fsg. 1,363 ft.
V. G. Schimmel et al No. 1 Geo. West, G. L. Haas Sur. S.D. 210 ft.

Milam County

Texedo Oil Co. No. 1 Graham, Charles Cornea Sur. Logged S.O. 1,135-36 ft.; T.D. 1,136 ft.; perf. core.
Texedo Oil Co. No. 1 Paul Garves, C. Robertson Sur. Drlg. sh. 900 ft.

McMullen County

Duncan Drlg. Co. No. 1 Martin Henry, sec. 6. S.D. 707 ft.
J. H. Reynolds No. 1 J. H. Shiner, sec. 82, Shumway Subd. T.D. 3,009 ft.; abd.

Medina County

J. R. Trentman et al No. 1 Carle Merc. Co., V. A. Johnson Sur. Drlg. sh. 1,300 ft.; sd. S.O.&G. 1,210-12 ft.

Nueces County

C. Andrade No. 1 John Dunn, P. Hinojosa Sur. No. 422. Drlg. sh.&L. 4,969 ft.
Corpus Christi Ref. Co. No. 1 J. R. Howington, O. and M. Oliver Sur. No. 156. R.U.
Renwar Oil Co. No. 1 Morgan, A.B.& M. Sur. 10¾-in. csg. 101 ft.; T.D. 5,837 ft.; run Schlumberger survey.
Richardson Pet. Co. No. 2 H. B. Baldwin, E. Villareal Sur. No. 1. R.U.
Rutherford Oil Corp. No. 1 L. A. Stewart, Denman Sur. T.D. 6,512 ft.; rmg.
Union Prod. Co. No. 1 Simmons, 1,000-ac. tr., Agua Dulce Gr. T.D. 8,706 ft.; P. B. 4,810 ft.; perf. csg. 4,810-35 ft.; S.I.; no ga.

Refugio County

Barnsdall Oil Co. No. 1 C. H. Fagan, Nicholas Fagan. M.I.M.
Continental Oil Co. No. 1 Scott Hrs., Dona A. Reogas Sur. 10¾-in. csg. 1,490 ft.; drlg. sh. 5,439 ft.
Hogan Oil Co. No. 1 Kelley, M. & A. Roache Sur. T.D. 6,437 ft.; P.B. 6,002 ft.; perf. csg. 5,992-6,006 ft.; flwd. 150 bbls. fluid per day, 15% oil, balance S.W.; well died; R.U. to pmp.
Hogan Oil Co. No. 2 Kelly, J. Powers Sur. Drlg. sh. 5,260 ft.

San Patricio County

A. L. Bob No. 2 Green, T. T. Williamson Sur. Cg. sdy. sh. 6,814 ft.
J. W. Cain et al No. 1 G. E. Guy, Geo. H. Paul Subd. Drlg. sh. 5,312 ft.
Conroe Drlg. Co. No. 1 J. R. Daugherty, Jas. McGloin Sur. Drlg. sh. 6,446 ft. no report.
D. W. Moore No. 1 Kelly, J. H. Drummon Sur. Drlg. sh. 4,810 ft.
Plymouth Oil Co. No. 1 Brigham, Geo. H. Paul Subd. T.D. 5,665 ft.; 7⅝-in. csg. cmtd. on bttm.

Starr County

J. L. Collins No. 1 Francisco B. Guerra, Santa Cruz Gr. Drlg. sh. 5,596 ft.
Sun Oil Co. No. 2-D Guerra, La Sacatosa Gr., 2 mi. SW of Cuevitas field. R.U.

Uvalde County

H. F. Wilcox O. & G. Co. No. 1 Morris, M. Carrello Sur. Drlg. L. 2,274 ft.

Victoria County

W. V. Bowles No. 2 Robertson, T. C. Burnham Sur. R.U.
Harry L. Edwards No. 1 Robertson, T. C. Burnham Sur. T.D. 5,624 ft.; P.B. to test.
Portilla Drlg. Co. No. 1 P. H. Welder, S.A.&M.G. Sur. R.U.
Superior Oil Co. of Okla. and L. A. Gillespie No. 1 Mahon and Buhler, San Antonio Valley Ditch Sur., Abst. 368. 10-in. csg. 849 ft.; drlg. sh. 2,410 ft.

Webb County

Boysen & Jones No. 1 Watkins, San Casimero Gr. Drlg. sh. 4,187 ft.
Colton, Leslie and Mitchell No. 1 Lopez, F. Lopez Sur. 55. T.D. 2,801 ft.; perf. csg. 1,694-99 ft.; swbd. brksh. wtr.; abd.
Gilcrease Oil Co. No. 1 Trofton, M. Lopez Sur. 282 ft. 10¾-in. csg. 46 ft.; T.D. 1,945 ft.; fsg.
W. S. Hill No. 1 Adami, A.B.&M. Sur. 345. Drk.

Willacy County

Magnolia Pet. Co. No. 1 Armendaiz, San Juan DeCarricitos Gr., Sh. 4. Drlg. sdy. sh. 9,384 ft.
Salvieja Oil Corp. No. 2 Garcia Ld. Co. Blk. 118. Drlg. sh. 3,600 ft.

Zapata County

J. W. Edwards No. 1 Garza, El Zoro ranch, Comitas Gr. T.D. 1,693 ft.; abd.
Killam & Radcliff No. 1 Rodriquez, Blk. 10, Sh. 12. Core sh. 815 ft.

EAST TEXAS

(Border Counties)

Rodessa—Cass County

Bay Oil Co. No. 5 Cobb, G. Crowder Sur. Drlg. 2,180 ft.
Bay Oil Co. No. 2 E. Parker, G. Crowder Sur. Drlg. 2,555 ft.
G. H. Chambiee No. 1 White & Walker, R. Potter Sur. Drlg. 200 ft.
Magnolia Pet. Co. No. 12 Rives, John Collum Sur. Drlg. 4,560 ft.
Union Prod. Co. No. 5 Bangus Unit, Tromwell Sur. Set 7-in. csg. 5,994 ft.; T.D. 6,007 ft.
G. H. Vaughn No. 1 Riley, J. Taylor Sur. Drlg. L.&sh. 4,840 ft.

Bowie County

King Oil Co. No. 1 Ames, J. A. Tolbott Sur. D.S. stuck 3,910 ft.

Harrison County

Ark.-La. Gas Co. No. 1 C. M. Abney, E. Little Sur. T.D. 4,820 ft.; bldg. drk.; reconditioning hole.
Ark.-La. Gas Co. No. 1 Pitts, C. Lockhart Sur. R.U.

Marion County—Rodessa

Arkansas-Louisiana Gas Co. No. 1 Holland, Hanks Sur. Drlg. L.&sh. 5,820 ft.
Ark.-La. Gas Co. No. 3 Wade Houston, Coy Sur. T.D. 6,099 ft.; set 7-in. csg. 6,065 ft.
Ark.-La. Gas Co. No. 1 Howard, Thos. Gillespie Sur. Set 10¾-in. csg. 2,010 ft.
Geo. Barham No. 1 Beard, R. Bennington Sur. R.U.
Geo. Echols No. 1 Whitfield, R. Bennington Sur. Drlg. sh.&L. 4,343 ft.
Flesh & Hootkins No. 1 Whitfield, Bennington Sur. Drlg. chlk. rk. 2,039 ft.
Gulf Oil Corp. No. 3-A Henderson, Bennington Sur. Drlg. 3,412 ft.
Gulf Oil Corp. No. 1-A Ray, Hanks Sur. Drlg. 2,128 ft.
Heyser, Heard and Ciardy No. 1-B Henderson, U. Ewing Sur. Cg. 6,031 ft.
Heyser, Heard & Ciardy No. 3 Henderson, Bennington Sur. Set 7-in. csg. 5,986 ft.; comp.: 30 B.P.H.; ¾-in. ck.
Hollandsworth Drlg. Co. No. 2 Hill, Smith Sur. Drlg. 3,614 ft.
Phillips Pet. Co. No. 1 Benefield, Hanks Sur. Drlg. 1,976 ft.
Phillips Pet. Co. No. 1 Denton, Coy Sur. Drlg. sh.&L. 3,440 ft.
Phillips Pet. Co. No. 1 Henderson, Gillespie Sur. Set 13-in. csg. 225 ft.
Phillips Pet. Co. No. 1 Pruitt-Lockett, U. Ewing Sur. Cg. L. 6,140 ft.
Shell Pet. Corp. No. 1 Whelan, Thos. Gillespie Sur. Set 12½-in. csg. 208 ft.
Shell Pet. Corp. No. 1 Whelan, Thos. Gillespie Sur. Drk.

Panola County

Glassell et al No. 1 Pierce & Chesbro, Soaps Sur. O.W.W.O.; old T.D. 5,881 ft.; W.O.
H. E. Preston et al No. 1 Rushing Est., Manning Smith Sur. T.D. 3,028 ft.; M.I. rig.
Texas Co. No. 1 Claude Adams, T. Cox Sur. Drlg. 4,137 ft.

WEST TEXAS WILDCATS

Andrews County

Rogers & Rogers No. 1 O. B. Holt, P.S.L. Sur. Tstg. 4,541 ft.
Seaboard Oil Corp. No. 1 Munger-Nix, sec. 1, Blk. A-4, P.S.L. Sur. Drlg. 4,110 ft.
H. C. Wheeler No. 1 T. M. Gardner, sec. 15, Blk. A-35, P.S.L. Sur. Drlg. 1,130 ft.

Bailey County

Duffey & Etz No. 1 Enochs, Tract 66, League 182, Floyd Co School Lands Sur. Fsg. baller 4,160 ft.

Brewster County

F. C. Dodson No. 1 Texas American Synd., sec. 66, Blk. 10, G.H.&S.A. Sur. Drlg. 7,200 ft.
Storey No. 1 Wilson, sec. 3, Blk. 212, T.& St.L. Sur. S.D. 2,545 ft.

Cochran County

Devonian Oil Co. No. 1 Duggan, Oldham Co. Sch. Ld. Sur. Tstg. 5,044 ft.
J. R. Meeker et al No. 1 Wright, Mills City Sch. Ld. Drlg. plug 4,930 ft.
P. N. Wiggins et al No. 1 Dean, NE cor. League 58, Martin Co. School Lands. Tstg. 5,077 ft.

Coke County

Barnett Pet. Co. No. 1 J. R. Mims, sec. 39 Blk. W, T.&P. Sur. S.D.O. 1,680 ft.
H. E. Ogden et al No. 1 Rawlins, sec. 390 Blk. B-21. Drlg. 2,445 ft.

Concho County

Barnett Oil Dev. Co. No. 1 Sims, Abst. 851, Carl Thiele Sur. S.D.R. 110 ft.
Sam Murray No. 1 R. G. Armor, sec. 105, T.&N.O. Sur. S.D. 356 ft.

Cottle County

F. P. Hinds et al No. 1 Lee, 5 mi. SW of Paducah, A.B.&M. Sur. Cr. 4,385 ft.
Wilcox O. & G. Co. No. 1 Richards et al, sec. 761, Blk. Y, W.&G. Sur. S.D. 275 ft.

Crockett County

Moore Bros. No. 1 Perner, sec. 37, Blk. 2, I.&G.N. Sur. Drlg. 9,086 ft.
J. N. Simpson No. 1 Hoover, G.C.&S.F. Sur. Drlg. bridge 1,931 ft.
Stewart & Cormas No. 1 Hoover, sec. 1, Blk. FF, B.B. Sur. S.D.O. 1,931 ft.

Culberson County

Grisham & Hunter No. 1 fee, sec. 14, Blk. 42, P.S.L. Sur. M.I.S.T.

Dawson County

Albaugh No. 1 Robinson, E.L.R.R. Sur. T.D. 5,038 ft.; tstg.
Atlantic No. 1 Scanlan, sec. 83, Blk. M, E.L.R.R. Sur. P.B. from 4,965 ft. to 4,932 ft.; S.D. 4,932 ft.

Dickens County

J. F. Morrisey et al No. 1 C. L. Bird, sec. 290, Blk. 1, H.&G.N. Sur. S.D.; W.O. 2,000 ft.

Ector County

Bodins et al No. 1 Edwards, Drlg. 4,600 ft.
Wentz Oil Co. No. 1-B Parker, S.D.O. 4,882 ft.; C.O. 800 ft.; O.I.H.
L. H. Wentz Oil Co. No. 1-B Parker, C.O. 4,259 ft.

Melhoan Drlg. Co. No. 1 Gulf Blakeney. Cg. 4,118 ft.

Edwards County

A. P. Carter No. 1 F. D. Sweeten, B.&B. Sur., 2 mi. E of Rock Springs. Drlg. 6,301 ft.
Lyles & Dan Auld No. 1 Henderson, H.E. &W.T. Sur. S.D. 3,200 ft.
Richmond Drlg. Co. No. 1 Brown, G.W. T.&P. Sur. S.D.O. 5,750 ft.

El Paso County

Tri-State Oil Co. No. 1 Kinkel. Prep. run tbg. 3,511 ft.

Fisher County

Daniel & Rhodes No. 1 Nichless, Geo. W. Lawrence Sur. S.D. 3,340 ft.
General Crude Oil Co. No. 1 Morrow, sec. 185, Blk. 2, H.&T.C. Sur. Drlg. 3,537 ft.
Southern Oil Co. No. 1 Bocat, H.&T.C. Sur. S.D.O. 4,016 ft.

Floyd County

Mills Bennett No. 1 T. Montgomery, F. J Latham Sur., 6 mi. S of Floydada. T.D. 5,082 ft.; fsg.

Gaines County

Amerada Pet. Corp. No. 1 R. W. Robertson, sec. 196, Blk. G, W.T.R.R. Sur. Fsg. swab 5,112 ft.
Carter, Continental & Plymouth et al No. 1 Geisecke. Drlg. 5,724 ft.
Continental No. 1-43 Moore, sec. 45, Blk. AX, P.S.L. Sur. Drlg. 300 ft.
Shell Pet. Corp. No. 1 M. B. Robinson, sec. 344, Blk. G, C.C.S.D.&R.G.N.G. Sur. R.U.S.T. 4,674 ft.

Garza County

Gulf Oil Corp. No. 1 Swanson, sec. 25, Blk. 2, H.&G.N. Sur. Drk.

Glasscock County

O. B. Greathouse No. 1 Burns, sec. 221, Blk. 29, W.&N.W. Sur. M.I.S.T.

Hockley County

Gulf Oil Corp. No. 1 M. G. Gordon, sec. 12, Blk. X, P.S.L. Sur. Drlg. 4,367 ft.
Gulf Oil Corp. No. 1 Mallett Ld. & Cattle Co., sec. 6, Blk. X, P.S.L. Sur. Drlg. 4,570 ft.
Honolulu Oil Co. No. 1-51 Dorthy Slaughter, Labor 51, League 37, Zavalla Co. Sch. Lds. Drlg. 4,710 ft.
Honolulu Oil Co. No. 1-77, Labor 77, League 37, Zavalla Co. Sch. Lds. Loc.
Sid Richardson No. 1 Slaughter, Maverick Co. Sch. Lds. Tstg. 4,994 ft.
The Texas Co. No. 2 Slaughter, Labour 92, League 37, Zavalla Co. Sch. Lds. Drlg. 4,965 ft.; S.O.

Howard County

Lockhart Oil Co. No. 1 Hussinger, sec. 67 Blk. 29, W.&N.W. Sur. Drlg. 2,908 ft.
W. F. McDermott et al No. 1 Lucas, sec. 18, Blk. 29, Twp. 1n, T.&P. Sur., 5 mi. N of Dodge pool. Drlg. 3,077 ft.

Hudspeth County

Haymon Krupp Oil & Ld. Co. No. 1 Thaxton, SE¼ sec. 34, Blk. 74, Twp 6 Drlg. 4,100 ft.
Haymon Krupp No. 1 Briggs, sec. 24, Blk 73, Twp. 7, T.&P. Sur. Drlg. 3,175 ft.

Jeff Davis County

Joiner Oil Corp. No. 1 Jones-Coffield. S.D. 3,500 ft.

Kent County

Thad A. Bryant Jr. No. 1 Haggins et al, sec. 118, Blk. 1, H.&G.N. Sur. Spudded and S.D.
Thad A. Bryant, Jr., No. 1 House, sec. 10, Blk. 1, H.&G.N. R.R. Sur., 6,000-ft. test. Drlg. 200 ft.

Lamb County

Toddie L. Wynne, Tr. No. 1 Neuenschwander, Labour 1, League 660, State Cap't. Lds. Drlg. 5,086 ft.

Loving County

Barnett Pet. Co. No. 1-A Johnson, sec. 2, Blk. 57, Twp. 1, T.&P. Sur. Drlg. 3,900 ft.
Bryant-Caraway et al No. 1 House, Pre-Emption Sch. Lds., sec. 10. Setting surface csg.
Carpenter & Grierson No. 1 Mrs. Bennie Barnes, sec. 22, Blk. C-25, P.S.L. Sur. Loc.

Lynn County

John L. Baldridge No. 1 Alma Lbr. Co., sec. 151, H.E.&W.T. Sur. Drlg. 3,570 ft.

McCulloch County

Westbrook et al No. 1 Johnson, A. Nevendorf Sur. S.D. 1,836 ft.
Nixon No. 1 Pierce. S.D. 1,001 ft.

Martin County

Harris-Anderson Oil Corp. No. 1 Mollie Robinson, sec. 33, Blk. 38, T.&P. Sur. S.D. 4,189 ft.

Menard County

G. A. Clements No. 1 Murchison, sec. 80, B.S.&S. Sur., 8 mi. E of Menard. Fsg. 933 ft.
C. D. Haggerty No. 1 Callon, sec. 36, Jim Franz Sur. Spud. and S.D.

Pecos County

Harry Baker et al No. 1 White & Baker, sec. 53, Blk. 194, C.C.&S.F. M.I.M.
J. J. Dorr et al No. 2 Payton, sec. 99, Blk. 8, H.&G.N. Sur. Cellar and pits.
Ed Falney No. 1 Trees, sec. 63, Blk. 8, H.&G.N. Sur. Fsg. 2,055 ft.
Magnolia Pet. Co. No. 1 McKee. Running tbg. 5,330 ft.
Messenger & Osborn No. 1 Humble-Young, sec. 49, Blk. 10. H.&G.N. Sur. Acid. 1,807 ft.; pmpd. 35 B.O. 35 hrs.; tstg. 1,807 ft.
S. Thompson No. 1 Elsinore Cattle Co., sec. 54, Blk. D, G.C.&S.F. Sur. Prep. drill deeper 7,129 ft.
Thompson & Minshall No. 1 Michaelson, 660 ft. N and W, sec. 24, Blk. 146, T.& St.L. Sur. S.D. 3,187 ft.
Trans-Pecos Oil Co. No. 1 Gallagher, T.&P. Sur. S.D. 1,610 ft.
Trans-Pecos Oil Co. No. 3-A Papham, G.H.&S.A. Sur. S.D. 1,934 ft.
Wilcox O. & G. Co. No. 1 Serf, sec. 27 Blk. 130, T.&St.L. Sur. Drlg. 1,686 ft.

Presidio County

L. C. Brite No. 4 fee, C NW¼ sec. 113, Blk. 12, G.H.&S.A. Sur. U.R. 4,375 ft.

Reeves County

Barnett Pet. Corp. No. 1 Ely, sec. 38, Blk. 71, P.S.L. Sur., 12 mi. NW of Toyah. Drlg. 3,982 ft.
Ohio Oil Co. No. 1 Papham, sec. 18, Blk. 54, T.&P. Sur. U.R. 890 ft.

Runnels County

E Z Oil Co. No. 1 B. Fletcher, E. C. Good Sur. T.D. 4,394 ft.; P.B. to 4,360 ft.; S.D.O. 4,384 ft.

Schleicher County

J. M. Cooper No. 2 B. Page, sec. 40, Blk. L, G.H.&S.A. Sur. S.D. 5,004 ft.
Tex-Tor Oil Corp. No. 1 Judkins & Spencer, C of SW¼ sec. 33, Blk. A A.&B. Sur. S.D. contract depth 6,043 ft.

Scurry County

Robinson Drlg. Co. No. 1 Martin, sec. 147, H.&T.C. Sur. T.D. 3,515 ft.; P.B. 1,834 ft.; C.O.
T. G. Shaw Oil Co. No. 1 First Natl. Bank. Fsg. 2,420 ft.

Sterling County

J. W. Sward No. 1 Brennand, sec. 107, Blk. 2, H.&T.C. Sur. S.D.O. 250 ft.

Stonewall County

General Crude Oil Co. No. 1 J. D. Smith, sec. 371, Blk. 2, H.&T.C. Sur., 12 mi. N Rotan. U.R. 2,095 ft.
Swanson & Parriott No. 1 H. T. Carlisle, sec. 293, Blk. D, H.&T.C. Sur. Drlg. 600 ft.

Sutton County

A. A. Basse and S. J. Sackett No. 1 W. A. Miers, sec. 54, Blk. 14, T.W.&N.G. Sur. S.D. 55 ft.
Ordovician Oil Co. No. 1 Evans, sec. 1, L. Stubblefield Sur., 32 mi. SE of Sonora W.O.C. Drlg. 4,125 ft.; topped Ellenburger 4,085 ft.

Terrell County

D. & S. Oil Co. No. 1 Sam Bell. Run. 10-in. csg. 549 ft.

Terry County

C. H. Hutto No. 1 Brownfield, E.L.R.R. Sur. S.D. 687 ft.

Tom Green County

Humble O. & R. Co. No. 1 Lewis & Wardlaw, sec. 5, Blk. 17, H.&T.C. Sur. Drlg. 5,932 ft.
Southern Cross Oil Co. No. 1 J. W. Wilson, sec. 30, Blk. H, A.B.&M. Sur. Loc.
Spinner No. 1 Reed, Mason Ferry Ranch Sur. Run. csg. 3,610 ft.

Upton County

W. D. Riser et al No. 1 King Ranch Oil & Lignite Co., sec. 8, Blk. 3, M.K.&T. Sur. Fsg. 730 ft.
Rutter et al No. 1 Egolb, sec. 5, J. H. Gibson Sur. Blg.; T.D. 3,294 ft.; S.D.O. 3,295 ft.
J. S. Pitman No. 1 D. Elder, C.C.S.D.& R.G.N.G. Sur., Blk. 3, sec. 14. Drlg. salt 2,050 ft.

Ward County

Cities Service No. 2 Brandenburg, sec. 4, Blk. 32, H.&T.C. Sur. Tstg. 2,092 ft.
M. J. Delaney No. 1 J. E. Cooper, H.&T.C. Sur. S.D.O. 3,021 ft.
J. E. Fitzpatrick et al No. 1 H. B. Carr, sec. 125, Blk. 34, H.&T.C. Sur. Drlg. 705 ft.
J. E. Fitzpatrick et al No. 1 F. K. Dyer, sec. 135, Blk. 34, H.&T.C. Sur. S.D. 1,000 ft.
Hoss & Downey No. 1 Meyers, sec. 17, Blk. 32, H.&T.C. Sur. Spd. and S.D.
Hoss & Downey No. 1 Ross Avery, sec 36, Blk. 1, H.&T.C. Sur. Fsg. 1,335 ft.
Patillo & Webster No. 1 Johnson. Drlg. 1,900 ft.
Sayre Oil Co. No. 1 Bertner, sec. 34, Blk. 1, H.&T.C. Sur. Drlg. 60 ft.
O. E. Schkode No. 1 Boogher, sec. 1, Blk. 32, H.&T.C. Sur. Drlg. 160 ft.
H. I. Waid No. 1 Brown Hrs., sec. 34, Blk. 1, H.&T.C. Sur. S.D. 1,831 ft.
L. F. White et al No. 1 Rector-Monroe, E cor. sec. 3, Blk. 1, W.&N.W. Sur. S.D. 4,710 ft.

Yoakum County

Bahago & Bond Oil Corp. No. 1 J. L. West, sec. 607, Blk. D, J. H. Gibson Sur. Reaming 5,216 ft.
Gulf No. 1 J. C. Futch, sec. 796, Blk. D, J. H. Gibson Sur. Drlg. 1,630 ft.
Humble No. 1 Abilene State Bank, sec. 37, Blk. AX, P.S.L. Sur. Drlg. 2,215 ft.
Ohio No. 1 Claywater, sec. 638, Blk. D, J.H. Gibson Sur. R.U.R.
Shell No. 1-C Baumgart, sec. 866, Blk. D, J. H. Gibson Sur. Cg. 4,846 ft.
Texas Co. No. 1 Walker, sec. 794, Blk. D El. 3,656 ft.; T.D. 5,180 ft.; P.B. 5,162 ft.; S.D. 5,162 ft.
Stogner & Pipkin No. 1 Blade, J. H. Gibson Sur. S.D.O. 5,307 ft.

E. C. TEXAS WILDCATS

Angelina County

J. C. Bonham No. 1 Cameron Lbr. Co. E. Miller Sur., 3 mi. SE of Zavalla. Skidding drk.
Gar-Flo Oil Co. No. 1 J. L. Russell, J. Morin Sur., 3 mi. E of Dibol. Tstg. 2,240 ft.
Ginter Co. No. 3 Copes Heirs, J. Morin Sur., 4 mi. E of Dibol. W.O.C. 2,200 ft.
C. E. Parrott No. 1 J. C. Burres, W. Plucker Sur., 2½ mi. W of Huntington. Drk.

Cherokee County

J. G. Mayo et al No. 1 J. H. Bowlery, W. H. Walters Sur. Drlg. 2,606 ft.
Merica Oil Co. No. 1 Cherokee Dev. Co., A. J. Acker Sur., 2 mi. E of Maydelle. Drlg. 5,022 ft.

Dallas County

Plaza Oil Co. No. 1 Davidson, Marchants Sur., 1 mi. NW of Seagoville. Spudded.

Falls County

McCleod et al No. 1 F. Bolton, J. R. Cockrill Sur., 4 mi. NW Rosebud. Fsg. 1,708 ft.

Franklin County

White-McGee & Harper No. 1 Harper, W. N. Dawson Sur., on Franklin-Hopkins Co. line, 6 mi. SW of Hagansport. R.U.

Freestone County

C. E. Rossiter No. 1 J. P. Fulton in J. P. Fulton Sur., 2½ mi. E of Donie. S.D. 956 ft.

Grayson County

Denver Prod. & Ref. Co. No. 1 E. B. Moore, E. Barnes Sur., ½ mi. NW of Whitesboro. Drlg. 622 ft.

Gregg County

Humble O. & R. Co. & Gulf O. Corp. No. 1 E. Robertson, M. Mann Sur., 2½ mi. SW of Longview Trinity test. El. 273 ft.; drlg. 8,557 ft.

Henderson County

Howard Pet. Co. No. 1 H. W. Barton, A. J. Allen Sur. S.D. 350 ft.
Jones-Mallory No. 1 A. Mallory, T. S. Mitchell Sur., 6 mi. SW of Mabank. M.I.M.

Hill County

J. Willis No. 1 W. P. Ball, S. Marshall Sur., 3 mi. NW of Covington. M.I.M.

Houston County

Peyton Bros. No. 1 J. N. Daniels, J. M. Procella Sur., ½ mi. N of Procella. S.D. 50 ft.

Lamar County

Cooper Bros. No. 2 L. B. Hayes, L. Roberts Sur. Loc.

Leon County

Lone Star Gas No. 1 Sarah Melasky, 1 mi. S of Buffalo pool. Drlg. 5,058 ft.

Limestone County

C. L. Brown No. 27 N. B. Boyd, R. B. Longbotham Sur., 3 mi. S of Wortham. T.D. 1,402 ft.; oil sd.; S.D.W.O. 1,455 ft.
J. S. Cosden, Jr. No. 1 J. J. Bower, J. Breeding Sur., near Prairie Hill. Drlg. 250 ft.
Stanolind O. & G. Co. No. 1 T. Norris, in Thresher Sur., 5 mi. N of Kosse; 6,500 ft. test; elev. 528 ft.; W.O.C. 8,441 ft.

McLennan County

Chapman & Kahn No. 1 Carl Hartsman, B. C. Walters Sur., 1½ mi. S of McGregor. Drlg. 810 ft.
Kilgore No. 1 J. M. Marrs, J. S. Rutland Sur., 2 mi. S of Bosque. W.O.C. 826 ft.

Navarro County

Natural Pet. Co. No. 1 Karen Brown, W. T. Turner Sur., 2 mi. E of Roane. Drlg. 600 ft.
Orchard & Biddle No. 1 Gibson, 6 mi. SW of Rural Shade, J. Bird Sur. Drlg. 3,100 ft.
Mrs. Jane Robinson No. 1 Fortson Bros., Eli Smith Sur., 5 mi. NE Corsicana. Drlg. 2,240 ft.
T. Sharpe et al No. 1 E. B. McDowell, T. Jordan Sur., 1½ mi. S of Bassets. S.D. 3,160 ft.

Smith County

Mayo-Housh & Thompson No. 1 J. B. Mayfield, Wm. Keys Sur., 4 mi. SE of Tyler. M.I.M.

Trinity County

Billnoski et al No. 1 Trinity State Bnk., B. F. Wright Sur., 2 mi. S of Trinity. S.D. 120 ft.

Upshur County

Tom Hunter and American Liberty No. 1 J. P. Carter, J. H. Fields Sur. Drlg. 7,363 ft.

NORTH TEXAS WILDCATS

Archer County

A. H. Bedinghaus No. 1 J. L. Anderson, Blk. 23, S.A.R. Sur. 10-in. 80ft.; W.O.C.
Hull & Silk No. 1 L. F. Wilson, sec. 25, A.T.N.C.L. Sur. Loc.
Thos. A. Jirik No. 1 D. L. Wolf, J. Poltevent A-348 Sur. Loc.
Wayne King et al No. 1 C. A. Arthur, sec. 3, G.H.&H. Sur. A-158. S.D. 210 ft.
Lewis Prod. Co. No. 1 W. C. Frey, sec. 17, P.P.S.L. Sur. Drlg. 2,210 ft.

Baylor County

D. S. Kelly No. 1 W. T. Waggoner, sec. 54, T.&N.O. Sur. S.D.O. 1,200 ft.

Clay County

Barnett Pet. Co. No. 1 Ben Nutter, sec. 30, Grayson Co. Sch. Lds. Drlg. 3,418 ft.
Wirt Franklin et al No. 1 Staggs, sec. 34, A.G.S.L. Sur. 12½-in. at 130 ft.; R.U.R.
Walter Gant No. 1 Bryant Edwards, Blk. 10, Marion Co. Sch. Ld. Matl., 6,000-ft. test.
Healdton O. & G. Co. No. 1 Wallace, Belcher Subd. Drlg. 3,882 ft.
Wood Pet. & Roy. Corp. No. 1 I. H. Kempner, Blk. 44, Bosque Co. Sch. Ld. Sur. A-10. R.U.R.

Cooke County

H. L. Nutting et al No. 1 H. P. Ware, A.C.C. Bailey Sur. A-44. Drlg. 825 ft.

Denton County

W. C. Curry et al No. 1 G. F. Owens, N. Rudder Sur. A-1,060. S.S.O. 1,570-80 ft.; S.D.O.

Foard County

Texas Co. No. 14 Johnson, sec. 37, S.P. R.R. Sur., Blk. L. Lime 3,760-80 ft.; treating with acid; C.O.

Jack County

Auers et al No. 1 Garrison, W.C.R.R. Sur. A-960. Drlg. 3,140 ft.
G. M. Gillespie No. 1 A. M. Street, sec. 3339, T.E.&L. Sur. U.R. 8¼-in. 2,215 ft.
Hanlon-Buchanan, Inc., No. 1 Ed M. Myers, N. F. Rudmose Sur. A-1,803. O.S. 3,830-40 ft.; shot with 40 qts.; 2,800 ft. of oil in hole; W.O.R.R. com. test.
Jones & Conklin No. 1 R. A. Heffner, H.&G.N. Sur. A-296. Drk.
O. J. Perrin No. 1 J. S. Rhodes, J. W. Coates Sur. A-1240. 6⅝-in. 3,125 ft.; W.O.C.
Taubert & McKee No. 1 R. H. Eatherly, J. H. Henderson Sur. A-1,749. Spud. and S.D.
Van Eman & Richards No. 1 Whitsell, Wm. McElroy Sur. A-599. Fsg. 3,235 ft.

Montague County

H. H. Powell No. 1 Arch Durham, W. J. Wagoner Sur. A-936. Drlg. 275 ft.
J. W. Sorrell et al No. 1 J. E. Walthall, Sam. H. Smith Sur. A-662. S.D.O. 2,720 ft.

Wichita County

Bolin & Whittington No. 1 Waggoner Bros., sec. 21, H.&T.C. Sur. Drk.
King & Fabor No. 1 J. N. George, J. Waldschmidt Sur. A-571. S.D.O. 3,394 ft.
Tom Medders No. 1 E. Fields, sec. 32, H.&G.N. Sur. Drlg. 1,900 ft.
F. W. Merrick, Inc., No. 1 W. T. Waggoner, sec. 35, H.&T.C. Sur., Blk. 5. Drlg. 1,580 ft.
E. T. Noble No. 1 K. P. Abernathy, sec. 9, T.C.S.L. Sur. A-282. R.U.R.
Rathke Oil Co. No. 1 S. B. Burnett "Gulf," sec. 4, H.T.&B. Sur. A-752. 7-in. csg. 3,550 ft.; S.L. 3,552-3,692 ft.; shot 225 qts.; 2,000 ft. O.I.H; C.O. and tstg.
E. J. Stump No. 1 M. P. Bishop, L. Netherly Sur. A-240. S.D.O.; S.L. 3,885-3,997 ft.
Joe A. Worsham No. 1 Waggoner Bros., sec. 13. B.S.&F. Sur. A-343. Bkn. slate and O.S. 3,738-3,870 ft.;shot 180 qts.; flowed 10 min. over mast.

Wilbarger County

Barry & Hayes No. 1 McGill, sec. 3, Blk. 9, H.&T.C. Sur. Drlg. 3,710 ft.
Loyd H. Brown No. 1 W. T. Waggoner, sec. 33, Blk. 6, H.&T.C. Sur. Drlg. 3,600 ft.
E. C. Lawson No. 1 Ruitsch, sec. 21, H. &T.C. Sur., Blk 9. Spudding.
T. L. Moore Drlg. Co. No. 1 Mrs. G. E. Blackman, sec. 30, Blk 3, H.&T.C. Sur. Spd.
Phillips Pet. Co. No. 1 W. T. Waggoner "Barger," sec. 11, H.&T.C. Sur., Blk. 14. Drlg. 2,615 ft.
B. R. Rainwater No. 1 J. A. Turkett, Blk. 8, W.C. Sur. Cmt. surf. pipe.

Young County

Anzac Oil Corp. No. 1 E. S. Graham, A. Hines Sur. A-135. S.L. 3,667-3,977 ft.; tstg.
N. B. Crenshaw No. 1 J. C. Dwight, sec. 1,444, T.E.&L. Sur. S.D. 400 ft.
Howard Pet. Co. No. 1 G. R. Stewart, sec. 84, C.S.L. Sur. U.R. 8¼-in. 2,840 ft.
Kadane-Griffith No. 1 Sanders, sec. 1989, T.E.&L. Sur. Drlg. 1,350 ft.

RANGER (CENTRAL TEXAS) DISTRICT

Callahan County

R. F. Gilman et al No. 1 W. A. Young, 5 mi. NW Clyde, sec. 37, B.B.B.&C. Sur. T.D. 2,100 ft.
J. H. Howell No. 1 E. I. Vestal, 1,149 ft. E line, 1,000 ft. N line, Jesse Dyson Sur., 2 mi. NE Cross Plains, rotary to 4,000 ft. Surf. to 100 ft.; drlg.
Hal Hughes No. 1 Poindexter, sec. 350, Geo. Hancock Sur., 2 mi. NE of Oplin. Set 7-in. 3,870 ft.; est. 1,000,000 ft. gas lime 4,368-89 ft., T.D., S.L.M.; est. 300 B.O.P.D.; 5-in. set 4,358 ft.; W.O.C.
J. C. Jackson et al No. 1 Thompson, 2 mi. S. Eula, sec. 30, B.B.B.&C. Sur. S.D. 1,955 ft.
R. F. St. John No. 1 A. E. Dyer, 4 mi. NW of Clyde, 1,385 ft. from E line and 1,323 ft. from S line of sec. 40. B.B.B. &C. Sur. H.F.W. 3,132 ft., T.D.; plugging.

Coleman County

J. F. Brock No. 1 J. H. Livingston, SE cor. SW¼ county, J. D. Waters Sur. No. 208. Drlg. 1,110 ft.

Comanche County

N. D. Gallagher et al No. 1 Mrs. B. I. Terry, Desdemona pool, N. H. Kuyken-

dall Sur. S.O. in Ellenburger. Drlg. 4,720 ft.

Dobbs Oil Co. No. 1 Hodges, sec. 11, Blk 2, H.&T.C. Sur.. T.D. 2,710 ft:; acid. 4,000 gal. 2,630-62 ft.; flowing 25 bbls. hourly thru ¼-in. ck.; tstg.

Eastland County

G. D. Chastain et al No. 1 Weddington, 4 mi N. Cisco, sec. 496, S.P.R.R. Sur. T.D. 4,079 ft.; plugging back.

Hickok Prod. & Dev. Co. No. 1 J. E. Donovan, 5 mi. NW of Cisco, 660 ft. from N and E lines of NW¼ sec. 489, S.P. R.R. Sur. Top Ellenburger 4,247 ft.; trt. 1,000 gal. acid at T.D. 4,280 ft.

J. D. Kittrell No. 1 Reynolds, 5 mi. E of Carbon, sec. 23, H.&T.C. Sur., Blk. 1, S.D. 988 ft.

Lone Star Gas Co. No. 1 M. Thomas, 5 mi. NW of Cisco, 668 ft. from N line and 660 ft. from E line of SE¼ sec. 478, S.P.R.R. Sur. Drlg. 3,100 ft.

Fisher County

Owens-Snebold & A. C. Varner No. 1 J. H. Milsap, 3,500-ft. wildcat, 2 mi. NW McCaulley, 330 SL 330 WL, sec. 61-2, H.&T.B. Sur. Drlg. 200 ft.

Haskell County

Fain-McGaha Oil Corp. No. 1 T. G. Hendrick, C W½ sec. 104, Indianola Ry. Sur. M.I.M.

Superior Oil Corp. No. 1 T. G. Hendrick, 330 ft. S line, 330 ft. E line, N½ sec. 9, A. Rodriguez Sur., rotary to 3,500 ft. Drlg. 2,220 ft.

Jones County

J. S. Bridwell No. 1 C. L. Carter, 220 ft. from N and E lines SW SE section 37-15, T.&P. Sur. Surf. to 100 ft.

Jack Burleson No. 1 T. J. Lotspeich, 220 ft. from S and E lines of sec. 40-15, T.&P. Sur. U.R. 6-in. to 2,146 ft.

Danciger No. 1 Hugh E. Roberts, 220 ft. from S and W lines, E 110-ac., NE¼ sec. 37-15, T.&P. Sur. Drlg. 1,120 ft.

F. A. Gillespie & Sons No. 1 J. N. Hatfield, 3 mi. N Noodle Creek field, 330 from N and E lines, 80-ac. tr. in M. Northington Sur. No. 270. Drlg. 1,270 ft.

Mack Hayes and Montour Oil Co. No. 1 Chittenden, 7 mi. SE Hamlin, Subd. 18, McMullen & McGloin Sur. 337. Drlg 2,750 ft.

Iron Mountain No. 1 D. J. Herbst, 5 mi. E Hamlin, 330 ft. from N and E Sub. 18, Austin Williams Sur. 339. Fsg. 1,100 ft.

Walter K. Jones No. 1 D. M. Neas, 506 ft. from E and 1,113 ft. from S of Neas 75 ac., D. Bustillos Sur. 189. Set 49 ft. 12½ in.; S.S.O. and 50,000 ft. gas 1,953-60 ft.; set 6-in. to 1,958 ft.; W.O.C.

F. W. Martin No. 1 B. N. Herndon, 330 ft. from S and W of NW sec. 1, M.E.&P. Sur. Fsg. collapsed csg. 1,750 ft.

F. W. Merrick et al No. 1 C. A. Cox, cent. Cox 119-ac. tr., J. H. Hughes Sur No. 201. Rig.

Owens-Snebold No. 1 Alice Rhodes, 4 mi. W of Nugent, 330 ft. from N and W lines of NW¼ sec. 31, T.&P. Sur., Blk. 15. Lost hole 950 ft.; skd. 20 ft. E; U.R. S.S.O. 1,980-90 ft.; R.B.S.O. 2,-227-45 ft.; U.R. 8-in. to 2,800 ft.

B. H. Roth No. 1 D. A. Kinney, 4,000-ft. test, 330 ft. from S and E of NW sec. 7-4, H.&T.C. Sur. U.R. 8-in. at 1,830 ft., T.D.

Stanton & Miller No. 1 Gaither, 4½ mi. N of Anson, sec. 38, B.B.B.&C. Sur. S.D. 2,180 ft.

Joe A. Worsham et al No. 1 J. H. Commons, 330 ft. from S and E lines, Steffens Subdiv., Lot 7, A. W. Hill Sur. No. 4. Set 12½-in. at 1,020 ft.; fsg. 1,500 ft.

Mills County

Balyaet & Boyd No. 1 Westbrook, 7 mi. W of Goldthwaite, 4,950 ft. from S line and 4,290 ft. from W line of Caldwell Co. Sch. Ld. Sur. T.D. 2,002 ft., T.D.; plugging.

Nolan County

Hantho-Nelson, Inc., No. 1 J. H. Withers, C SW¼ sec. 65-21, T.&P. Sur. Wildcat to drill 4,000 ft. Spd.

Palo Pinto County

Brazos River Gas Co. No. 5 M. B. Costello B, 1½ mi. N Pickwick, 1,397 ft from N line and 150 ft. from W line of survey (W line being river bank), 660 ft. SW No. 4, R. R. Williams Sur. Drlg. 2,860 ft.

W. H. Clement No. 1 Federal Life Ins. Co., 2 mi. W Mineral Wells, sec. 51, T.&P. Sur., Blk. A (E of B). Drlg. 1,-510 ft.

Bill Cole et al No. 1 J. W. Harris Est., NW cor. county, De La Garza Sur. S.D. 950 ft.

King Oil Co. No. 1 S. F. Lee, 4 mi. NW Graford, 933 ft. from N and W lines of sec. 1,744, T.E.&L. Sur. T.D. 4,362 ft., contract depth.

Ernest Lloyd et al No. 1 McClure, 3 mi NE Graford, sec. 2,004, T.E.&L. Sur S.D. 1,200 for csg.

Shackelford County

Danciger No. 2 J. E. McCown, 330 ft. from S and E sec. 158, B.B.B.&C. Sur., N of set to Haterius. U.R. 8-in. to 1,907 ft.; S.S. gas.

Joe DeGrazier No. 1 Harbough, E cen part of county, sec. 1,563, T.E.&L. Sur 4,500-ft. test; drlg. 1,000 ft.

Forest Dev. Corp. No. 1 T. G. Hendrick, NW cor. of county, 2,600 ft. from N line and 4,300 ft. from W line of sec. 1. A.B.&M. Sur. Est. 15,000,000 ft. gas per day 1,603-17 ft.; gas 1,662-65 ft., incr. est. 4,000,000 ft., 1,680-85 ft.; est. 1,000,-000 ft. 1,804-06 ft. and 1,810-15 ft.; S.S. oil and wtr. 1,864 ft.; inc. wtr. 1,880-82 ft.; fsg. U.R. lugs 2,032 ft., T.D.

Hugh King, Jr., et al No. 2 Davis-Walker sec. 55-13, T.&P. Sur. S.S.O. 3,427-32 ft.; drlg. 3,925 ft.; carrying 2 B.W.

Iron Mountain Oil Co. No. 1 E. O. Beck NW cor. county, 300 ft. from S line and 299 ft. from W line of sec. 162, B.B.B &C. Sur. Est. 100 bbls. oil per day; 1,905-33 ft., T.D.; ran 6-in.; W.O.C.

C. J. Kleiner et al No. 1 Morris, 2 mi. NE Bluff Creek pool. sec. 187, E.T.R.R. Sur Run 5-in. to 2,733 ft.; H.F.W. 3,303 ft., T.D.; plugging.

R. C. Parker No. 1 J. Smalley, NW cor. of NE¼ county, 1,245 ft. from N line and 1,260 ft. from E line of sec. 11, E.T.R.R Sur. Spd.

Ungren & Frazier No. 1 J. S. McKeever, 306 ft. from W line, 354 ft. from N line, NW¼ SW ¼ sec. 14-3, H.&T.C. Sur. 3,500-ft. test; M.I.M.

Stephens County

Danciger Oil Ref. Co. No. 1 Mrs. Aileen Copeland, 8 mi. SE Ivan, 1,196 ft from E line and 350 ft. from S line of sec. 1, M.E.P.&P. Sur. U.R. 2,755 ft.

Graham, Hafner, Lane & Inman No. 1 J N. Yocum, 5 mi. SE of Frankell, 250 ft. from N and E lines of farm or approx. 2,525 ft. from E line and 1,400 ft. from S line of John R. Carter Sur Trt. 1,000 gal acid 3,575-90 ft.; est. 25-50 bbls. per day.

I. C. Little No. 1 R. M. Rogers, NE¼ of county, 150 ft. from E line and 1,980 ft. from S line of sec. 28, T.&P. Sur Blk. 5. Tstg. after 10,000-gal. acid 3,960-4,055 ft., T.D.; with 3,000,000 ft. gas.

G. Willard Rich No. 1 J. W. Andrews, 5½ mi. E Moran, 330 ft. from W line, 450 ft. from S line, NW¼ sec. 39-7, T.&P. Sur. 4,250-ft. test.

Stonewall County

General Crude Oil Co. No. 1 J. D. Smith, SW cor. county, 330 ft. from S and E lines of sec. 371, H.&T.C. Sur., Blk. 2. Set 12½-in. at 2,079 ft.; drlg. 2,092 ft.

F. B. Parriott No. 1 H. T. Carlile, 330 ft. from S line, 990 ft. from E line, SW¼ NE¼ sec. 293, Blk. D, H.&T.C. Sur., rotary to 5,500 ft., 6 mi. NW of Swenson. Drlg. 700 ft.

Taylor County

Dr. W. C. Braham et al No. 1 Ernest Armstrong, 3½ mi. E of Abilene, 220 ft. from S line and 330 ft. from W line of NE¼ SE¼ sec. 40, B.A.L. Sur. S.D. 800 ft.

Bert Fields et al No. 1 Sears, sec. 223, Blk. 64, H.&T.C. Sur. S.D. 1,530 ft.

A. Findley No. 1 Bowles Est., NE cor. county, sec. 26, B.A.L. Sur. Tstg. 1,873-80 ft.

Throckmorton County

Humble O. & R. Co. No. 1-A Reynolds Cattle Co., 330 ft. from S and E lines. sec. 7-2, A.B.&M. Sur. H.F.W. 2,525-30 ft.; U.R. 8-in. to 2,572 ft., T.D.

Morris & Spoonts No. 1 Alden Bros., NW cor county, 1,350 ft. from E line and 5,210 ft. from S line of Raymond Sanches Sur. A-248. Drlg. 810 ft.

Henry Zweifel No. 1 J. H. Lee, 4 mi. NE of Woodson, 930 ft. from E line and 2,011 ft. from S line of J. A. George Sur. T.D. 865 ft.; S.D.

Wise County

Latex Oil Co. No. 1 Smith, 3 mi. E of Bridgeport, Jas. Couch Sur. T.D. 4,075 ft.; P.B. to 3,910 ft.; S.D.; W.O.

North Texas Completions

(Week ending February 19)

Archer County

Brown & Kriss No. 6 G. R. Campbell, 1,226-39 feet, 25 bbls. W. T. Hutcheson, Jr., No. 6 L. F. Wilson, 1,212 feet, dry. Westmount Oil Co. No. 6 T. J. Dempsey, 1,083-1,108 feet, 10 bbls.

Clay County

Bridwell Oil Co. No. 2 T. C. Thornberry, 1,098-1,112 feet, 200 bbls. Sussex Oil Corp. No. 9 C. J. Schumake, 1,126-50 feet, 18 bbls.

Cooke County

F. W. Merrick, Inc., No. 15 C. A. Stelzer, 864 feet, dry. Pace Petroleum Corp. No. 5 J. R. Winstead B, 1,181-1,221 feet, 310 bbls. W. S. Temples and others No. 1 J. N. McArdle, 1,600 feet, dry. Texas Co. No. 4 Tony Trubenbach, 760-91 feet, 125 bbls.

Foard County

Texas Co. No. 14 L. K. Johnson, 3,675-3,779 feet, 1,750,000 feet of gas; No. 15 L. K. Johnson, 3,514-72 feet, 365 bbls.

Jack County

Bennett Petroleum Corp. No. 1 S. M. Mantooth, 3,165-97 feet, 450 bbls. Cockburn Oil Co. No. 1 S. M. Mantooth, 3,225-3,303 feet, 165 bbls. W. H. Dearong No. 2 Mitchell, 3,015-3,122 feet, 160 bbls. Hanlon-Buchanan, Inc., No. 1 Ed Myers, 3,430-53 feet, 55 bbls., wildcat. Ohio Fuel Supply Co. No. 1 J. W. Birdwell B, 2,970-84 feet, 155 bbls.

Montague County

Continental Oil Co. No. 39 N. J. Howard, 970-90 feet, 12 bbls.; No. 40 N. J. Howard, 1,403-10 feet, 20 bbls.

Wichita County

Burk Royalty Co. No. 1 W. L. Warren, 3,870-3,946 feet, temporarily abandoned, dry. L. T. Burns and C. E. McCutcheon No. 1 First National Co., 3,629-3,845 feet, 83 bbls., flowing 3 hours. Christie Bros. and Hickman Drilling Co. No. 2 W. P. Bolding, 3,630-3,731 feet, 405 bbls., flowing four hours. E. W. Jones, Inc., No. 1 W. L. Hodges, 3,835-3,977 feet, 122 bbls., pumping 22 hours. Kadane Griffith and others No. 1 Mrs. Anna Mangold, line well, 3,706-3,832 feet, 960 bbls.

King Oil Co. and others No. 3 Mrs. Anna Mangold, 3,780-3,812 feet, 816 bbls. Petroleum Producing Co. No. 85 First National Co., 3,657-3,842 feet, 713 bbls. Pois & Schulz No. 9 Ed Foster C, 986 feet, dry. George Proctor No. 25 Ed Foster A, 1,532-50 feet, 125 bbls. Sunray Oil Co. No. 1 First National Co., "Munger," 3,767-3,883 feet, 165 bbls in 24 hours; No. 1 Mrs. Anna Mangold, 3,677-3,760 feet, 961 bbls. in 24 hours. Mrs. Hulda B. Wallace No. 1 W. J. Logan and others B, 3,642-3,757 feet, 956 bbls. in 24 hours. Wilson-Ligon and L. T. Burns No. 1 Munger Farm Co., 3,692-3,870 feet, 672 bbls. in 24 hours. Joe A. Worsham No. 1 J. L. and T. J. Waggoner, 3,717-3,870 feet, 875 bbls. in 24 hours. Jennings Drilling Co. No. 2 Grace Jennings, 1,816 feet, dry. Pois & Schulz No. 4 Foster B, 1,281 feet, dry.

Wilbarger County

Kriss & Wiggins No. 1 W. T. Waggoner, 3,035 feet, dry.

Young County

F. W. Bennett No. 2 J. H. Robertson, 3,580-3,632 feet, 1,000 bbls. in eight hours, flowing. Black Gold Oil Co. No 1 G. W. Alberts, 4,097-4,161 feet, 150 bbls. in 24 hours, flowing; No. 1 E. G. Williamson, 3,807-3,919 feet, 500 bbls. in 24 hours, flowing. F. S. Johnson No. 9 E. E. Hall, 719-30 feet, 15 bbls. Pitzer West and others No. 2 G. W. McComas, 3,880-3,924 feet, 250 bbls. Henry Zweifel No. 2 W. C. Buford, 3,454-56 feet, 20 bbls. in 24 hours.

BUSINESS MAN EXPLAINS

(Continued from Page 61)

we cannot spare the cash from the business. If we did not pay a dividend the government would slap a tremendous penalty tax on us. To keep from wasting money by the payment of a penalty tax, we had to declare a dividend and because we could not spare the cash from the business, we had to pay that dividend in two-year notes. Maybe we can pay the notes at the end of two years—maybe not.

The government knows as much about business as a hog knows about war. It slaps a penalty tax on a company that does not spend every penny it makes in profits, in spite of the fact that common sense and business experience has shown that no company can safely operate without a sound cash, liquid surplus—without providing for rainy days.

In 1929, this company was on a sound financial footing, with a substantial surplus; then, as you know, the banks folded up in 1931 and left us with exactly $237 in cash in the safe. That was all we had except buildings, machinery, and inventory, and nobody could eat any of those without getting indigestion. Fortunately, our credit was good enough so that we could borrow money. We had to go out and borrow money, but we never missed a payroll.

We are in another business depression now, but in spite of that, the government, in this undistributed profits tax, says that if we reserve a penny out of what we earn as a cushion to take us through the depression, when we are sure to have losses, it will slap a penalty tax on us. If that is not a cock-eyed law and a screwball policy, no one outside of an insane asylum ever invented one.

I am telling you this so that you can see when the government by this cock-eyed penalty tax undermines this business it is not doing you any good.

What Is Right

It is hard enough for an old fellow like me to bat around the country in airplanes and sleeping cars selling sucker-rods, without being bedeviled and pestered, harassed and treated like a convict by the government, and I am getting tired of it. Old and tired as I am, I have no notion of lying down or quitting, if we can have the right kind of understanding and cooperation in this shop, and I am going to wind up this speech by telling you what I think is the right thing for all of us to do.

1. Let us have faith in each other—let the fellows in one department have faith in and good understanding with those in every other department.

2. Let us have faith between every employe and the management—between every employe and supervisors, foremen, superintendent and president.

3. If we have troubles, let us get together and talk them out and settle them like men should.

4. Let us all figure that this is our business and when anyone can cut out some waste or loss or make an improvement, he is benefiting himself and every one in the plant and not merely benefiting a soulless corporation.

5. Let us have the full and hearty cooperation that will insure steady employment and stability for all of us.

In closing, let me say that my father was known as "Golden Rule" Jones. He was first called that in derision by people who thought he was crazy when he tried to do the decent thing by his employes, and everyone he came in contact with.

I shall be very happy if I can ever get to be as well thought of as my father was. I shall be proud if I can get to be as good a man as he was. I want the spirit that moved him in everything he did to move me and you. If you do for me what you would have me do for you, we shall be happy and contented in our work. We shall be just as well paid for our work as the business will stand, and if you will do that with good spirit, I will travel 100,000 miles next year, if that becomes necessary, to get the results.

Market Record of Active Oil Stocks

Compiled by Carl H. Pforzheimer & Co., 25 Broad Street, New York City, Member New York Stock Exchange and New York Curb Exchange

New York Stock Exchange

1938 High	1938 Low	Week ending Feb. 19 Sales	High	Low	Close	Stocks—	Total shares outstanding	Par value	Latest dividend	Payable or last paid	Dividends paid in 1936	1937 High	1937 Low	1936 High	1936 Low
70½	57	2,000	70½	64½	70½	Amerada Corp.	788,675	N.P.	50cQ	3-31-38	$2.00	114⅞	51½	125½	75
23	20	6,800	23	21	23	Atlantic Refining	2,664,000	$25	25cQ	3-15-38	1.25	37	18	35⅛	26⅝
18	14⅛	3,300	17¾	16¼	17	Barber Co.	387,149	$10	75c	12-16-37	.50	43⅜	10⅛	38½	21
16⅛	13	16,000	15⅜	14⅜	15⅛	Barnsdall Oil Co.	2,247,974	$5	25cQ	2-1-38	.80	35¼	10	28¼	14⅛
10½	8½	15,100	9½	9⅛	9½	Consolidated Oil Corp.	13,919,417	N.P.	20cQ	2-15-38	.80	17⅞	7	17¼	11½
34⅜	27½	12,400	30⅜	28½	30⅜	Continental Oil of Delaware	4,682,615	$5	25cQ	3-31-38	1.50	49	24	44⅞	28⅛
8⅞	6¼	7,900	8	7¼	8	Houston Oil (new)	1,098,618	$25	....	10-17-30	....	17⅝	4¾	13⅞	6⅜
22⅝	17⅛	1,600	19	18¼	19	Mid-Continent Petroleum	1,855,912	$10	$1	11-1-37	1.15	35⅜	14	30⅞	17¼
17¾	14	300	15¾	15¾	15¾	Mission Corporation	1,399,345	N.P.	25c	12-24-37	.45	34	15	29⅞	16¾
22½	14¼	10,900	19½	16⅝	19½	National Supply	382,591	$25	$2 pf.‡	12-22-37	....	41⅜	17⅝	75½	19⅞
14⅞	11⅞	8,500	13¼	12¼	13¼	Ohio Oil Co.	6,563,377	N.P.	50cSA	12-15-37	.60	22⅞	9	18	12⅛
15⅞	11¾	500	12⅝	12¼	12⅝	Pacific Western Oil	1,000,000	N.P.	75c	12-15-37	.65	29¾	11¾	23½	11⅜
9	8	100	9	9	9	Pan American Pet. & Trans.	4,702,945	$5	$1*	12-21-37	.60*	17⅛	7	20⅝	12¼
42½	34⅛	9,200	38¾	36⅞	38⅜	Phillips Petroleum	4,449,052	N.P.	50cQ	3-1-38	2.50	64	30⅛	52⅜	38⅛
19¼	16¼	1,700	18¼	17½	17⅞	Plymouth Oil Co.	1,050,000	$5	35cQ	9-30-37	.90	29⅞	13	27¾	11⅞
13½	10¼	21,600	11¾	10⅝	11¾	Pure Oil Co.	3,281,120	N.P.	25c	12-1-37	....	24⅜	8¾	24⅞	16
7⅞	5⅜	5,900	6¾	6¼	6½	Richfield Oil Corp.	3,986,638	N.P.	25c	12-24-37	....	6½	4⅛	..	..
25¾	20	3,700	23⅝	22⅛	23½	Seaboard Oil of Delaware	1,224,283	N.P.	25cQ	12-15-37	1.00	54⅛	16	44	30⅛
18¼	14⅜	4,500	15⅝	14⅜	15	Shell Union Oil	13,070,625	N.P.	50c	12-20-37	.25	34¾	14⅞	28¼	14⅜
34¾	24⅛	1,900	29⅝	26⅞	29½	Skelly Oil	1,006,348	$15	50c	12-15-37	..	60⅝	26½	47⅜	19½
16⅜	13⅜	27,200	15⅞	14⅜	15½	Socony-Vacuum	31,151,071	$15	25c	3-15-38	.70	23¼	13	17½	12½
33⅞	28⅝	7,400	32½	30¾	32⅝	Standard Oil of California	13,014,754	N.P.	35cQ†	3-15-38	1.20	50	27⅛	47⅝	35
35½	31⅞	7,500	32¾	31⅞	32⅛	Standard Oil (Indiana)	15,196,241	$25	25cQ	3-15-38	2.40	50	26½	48½	32¾
35½	34	100	35½	35½	35½	Standard Oil of Kansas	134,841	$10	$5	12-20-37	1.00	43	30⅝	31	25
51⅜	44½	23,200	51	48⅝	51	Standard Oil of New Jersey	25,856,081	$25	$1.25SA†	12-15-37	2.00	76	42	70⅜	51⅛
57⅞	48½	1,200	50⅝	49½	50	Sun Oil	2,156,825	N.P.	25cQ	3-15-38	$1 & 6% Stk.	77½	44½	91	70
3⅜	2½	5,900	2¾	2½	2⅝	Superior Oil Corp.	1,388,079	$1	....	....	....	7¾	1½	6¾	3
44⅞	37¼	22,400	42⅛	39⅝	42⅛	Texas Corp.	10,896,858	$25	50cQ	4-1-38	1.50	65⅛	34¾	55¼	28⅞
4⅞	3⅝	3,300	4⅝	4¼	4¼	Texas Gulf Producing Co.	888,134	N.P.	10c	12-23-37	.05	9⅝	2	8⅞	4⅜
9¾	7⅜	14,700	9¾	8⅝	9¾	Texas Pacific Coal & Oil	888,237	$10	10c	3-1-38	.25	16⅝	5⅜	15¼	7½
15½	13⅛	6,500	13⅞	13½	13⅞	Tide Water Associated	6,288,512	N.P.	25cQ	3-1-38	.70	21⅝	13⅛	21⅜	14¾
21¼	18½	3,600	21⅛	20⅜	20⅞	Union Oil of California	4,386,070	$25	30cQ	2-10-38	1.00	28¼	17½	28½	20¾
23½	21⅞	300	22	22	22	Union Tank Car Co.	1,200,000	N.P.	40cQ	3-1-38	1.20	31½	22	31⅝	22⅝
2⅝	2¼	200	2½	2¼	2½	Wilcox Oil & Gas	424,839	$5	....	5-10-28	....	6¼	1¾	5¼	2⅜

*Payable in 3½% notes. †Includes extras. ‡One-tenth share $2 preferred stock.

New York Curb Exchange

1938 High	1938 Low	Week ending Feb. 19 Sales	High	Low	Close	Stocks—	Total shares outstanding	Par value	Latest dividend	Payable or last paid	Dividends paid in 1936	1937 High	1937 Low	1936 High	1936 Low
9⅜	7¼	600	8⅝	8½	8⅝	American Republics Corp.	1,308,049	$10	30c	12-27-37	....	10	6⅝	..	..
10¼	8¼	700	9⅜	9	9⅜	Bridgeport Machine Co.	260,000	N.P.	1.25	12-30-37	$1.00	21⅜	7	21	13¼
39	35	100	37	36¼	36¼	Buckeye Pipe Line Co.	200,000	$50	75cQ	3-15-38	3.25	51½	36	50	39¾
107	100	No sales	..	..	..	Chesebrough Mfg. Co.	120,000	$25	$1.50Q†	3-21-38	7.00	123	95½	124¾	105
2	1⅝	15,000	1¾	1⅝	1⅝	Cities Service	37,804,394	N.P.	....	6-1-32	....	5⅜	1½	7⅜	3
2⅜	1½	3,200	2	1⅝	2	Cosden Petroleum	399,687	$1	....	....	....	5½	1½	4½	1½
27½	22½	4,700	24⅞	23	24¾	Creole Petroleum	6,974,356	$5	50cSA†	12-15-37	.50	38¾	20¼	39	19⅞
8¾	7	100	7⅛	7⅛	7⅛	Darby Petroleum	351,390	$5	25cSA	1-15-38	.50	18⅝	6½	18⅛	9
3½	2½	1,000	3¼	3	3	Derby Oil & Refining	263,162	N.P.	....	.....	....	8⅝	2¼	6⅝	1⅞
31	31	No sales	..	..	..	Eureka Pipe Line	50,000	$50	$1Q	2-1-38	4.00	47½	24½	47½	38½
41¾	37	8,300	42	39	42	Gulf Oil Corp.	9,076,202	$25	25cQ	12-1-37	1.50, 100% Stk.	63½	33	59	36
66½	60	2,000	64⅞	62¾	64½	Humble Oil & Refining	8,923,935	N.P.	37½c	4-1-38	1.50	87	54⅞	80	57
18⅞	17⅞	1,500	18¾	18⅛	18¾	Imperial Oil of Canada	26,919,871	N.P.	62½cSA†‡	12-1-37	1.25	24¼	14½	24½	19¾
7¾	6⅝	200	7¼	7⅛	7¼	Indiana Pipe Line	300,000	$10	50cSA	11-15-37	.80	15	5⅞	9¾	5½
30⅝	28½	2,500	30½	29⅞	30¼	International Petroleum	14,247,088	N.P.	$1.25†‡	12-1-37	2.50	39½	23½	39⅝	32⅝
5	3¼	1,200	5	4½	4½	Kirby Petroleum Co.	500,000	$1	10c	9-15-37	.20	8¾	2⅜	5¾	2⅝
25⅛	18¾	4,500	22¾	20½	22¾	Lion Oil Refining	270,000	N.P.	50cQ†	12-24-37	.75	34	12½	17¾	7⅜
9¼	7⅛	1,700	8	7¾	8	Lone Star Gas	5,382,723	N.P.	20c	4-20-38	.60	14¼	5¼	14¼	9⅞
9⅜	8⅛	4,000	9	8⅝	8¾	Louisiana Land & Exp.	3,000,000	N.P.	20cQ†	12-15-37	.50	15¼	6¾	15⅜	9⅞
7⅝	7	600	7¾	7¾	7¾	Midwest Oil Co.	998,444	$10	50c	12-15-37	.	14⅝	6¼	..	..
5¼	4⅝	1,100	5⅛	5	5	Mountain Producers	1,682,182	$10	30cSA	12-15-37	.60	7⅞	4⅛	8⅜	5
14⅝	13	1,900	13½	13⅛	13½	National Fuel Gas	3,810,183	N.P.	25cQ	1-15-38	1.00	19½	12	23	17⅜
9¼	7¾	600	9⅛	8⅞	9	National Transit	509,000	$12.50	55cSA	12-15-37	.75	12½	7¼	15¾	9¼
2⅝	1¾	2,700	2⅝	2¼	2⅝	New Mexico and Arizona	1,000,000	$1	1c	12-1-36	.01	5	1⅛	6⅝	1⅝
4½	4	No sales	..	..	..	New York Transit	100,000	$5	15c	4-15-38	.35	5⅜	3⅞	6¼	4¼
6	5½	300	6	5½	6	Northern Pipe Line	120,000	$10	25cSA	12-1-37	.40	12¾	5¾	9¾	4⅞
7⅛	5⅝	82,100	7⅛	6⅛	6¾	Pantepec Oil	1,608,700	N.P.	....	.....	...	9⅝	2¾	10⅛	3¼
3½	2⅞	1,200	3⅛	2⅞	2⅞	Root Petroleum Co.	336,045	$1	25c	2-1-37	.50	13¾	2	19¼	4½
4	3 ⅛	600	3⅝	3½	3½	Ryan Consolidated	296,931	N.P.	....	.....	....	6½	2¼	4¾	1⅞
5⅜	4⅜	No sales	..	..	..	Southern Pipe Line	100,000	$10	15cSA	3-1-38	.25	7¼	3⅞	7⅞	3¼
38½	37¼	200	38	37½	38	South Penn Oil	1,000,000	$25	$1,15Q†	12-28-37	2.60	56	35	44	32½
22	22	No sales	..	..	..	Southwest Penna. Pine Lines	35,000	$50	50cQ	12-31-37	13.00	42	20	60	44
18	17	2,400	17½	17	17⅜	Standard Oil of Kentucky	2,604,790	$10	25c	3-15-38	1.35	21⅛	14¾	23⅜	17⅛
7½	7	300	7¼	7	7	Standard Oil of Nebraska	188,403	$25	25c	3-29-37	.25	13¾	8	14⅝	11
22	19	300	20¼	19½	20¼	Standard Oil of Ohio	753,740	$25	25c	3-15-38	2.00	45	16	40	21¾
3¼	2⅞	2,900	3	3	3	Sunray Oil	1,910,119	$1	10c	12-24-37	.10	4⅜	2	5	2⅝
4⅜	4	400	4	4	4	Texon Oil & Land	336,028	$2	15cQ	1-3-38	.60	7⅝	2	9¾	5⅝
7⅝	5½	700	6½	6	6	Transwestern Oil Co.	750,000	$10	....	.....	....	13⅞	4⅝	..	..
5¼	3½	11,000	4¼	4	4¼	United Gas Corp.	7,818,959	$1	10c	9-15-37	.20	13⅝	3	10¾	4

†Includes extras. ‡Payable in Canadian funds.

Note—In comparing highs and lows for the several years in the two tables, it will be necessary to take into consideration cases where there have been stock split-ups.

PERSONAL

J. A. BROWN, president of Socony-Vacuum Oil Company, Inc., returned to New York headquarters of the company last week. He had been in Europe for an extended visit.

J. C. HUNTER, oil operator and ranch owner, of Abilene, Tex., was chosen president of that city's chamber of commerce last week. He is head of the West Central Texas Oil and Gas Association and a former Culberson County judge.

W. J. KENNY, chief of the oil and gas unit of the Securities and Exchange Commission, with headquarters in Washington, D. C., will be in Oklahoma from February 28 to March 2, it is announced. He will confer with regional officers of the commission and meet officers and members of the Mid-Continent Royalty Owners Association.

LEROY A. BRADY, executive secretary of the New York Fuel Oil Association for the past five years, has resigned to become assistant to G. HARVEY PORTER, managing director of the Oil Burner Institute.

F. E. PACKER, chairman of the American Petroleum Industries Committee (central division), was a speaker before the Illinois Bar Association, meeting in Peoria. He declared a fundamental cause of the current recession is destruction of capital through taxation. "Capital," he said, "is being destroyed through taxation, which tends to depress wages, create unemployment and further destroy purchasing power, which can only end in the destruction of the capitalistic system. The oil industry is the heaviest taxed group in the United States."

GRANVILLE TIERNEY, of the Amerada Petroleum Corporation's land department in Kansas, has been made a member of the Kansas oil-field nomenclature committee.

RICHARD GRAY SOPER, president of the Dallas County (Texas) Gas Company, and MISS RUTH GREGORY, of Pittsburgh, Pa., were married in Pittsburgh Monday of last week. The bride's father, THOMAS B. GREGORY, is chairman of the board of the Manufacturers Light & Heat Company and vice president of the Columbia Gas & Electric Company.

COL. WILLARD T. CHEVALIER, vice president of the McGraw-Hill Publishing Company, New York, and editor of the Engineering News Record, is to be the principal speaker Friday evening, February 25, before the Mid-Continent section of the American Institute of Mining and Metallurgical Engineers, meeting in Tulsa. He will discuss the role of the engineer in major economic and social problems, taking as his subject, "Now What?"

BONNEAU PETERS, chief scout for the Standard Oil Company of Louisiana, was elected president of the Shreveport, La., baseball team in the Texas league last week. He had been instrumental in bringing the team to Shreveport.

J. P. ROCKFELLOW ("John D." to intimates), assistant manager of the Union Oil Company of California industrial relations and personnel department, was stricken with appendicitis in Vancouver, B. C., last week and underwent an operation in a Vancouver hospital. He is recovering.

WALTER L. BROWN, attorney of El Dorado, has resigned from the Arkansas State Board of Conservation to devote more attention to his private interests. GOVERNOR BAILEY is expected to name a Miller County operator to succeed him, since the Rodessa extension producers have no representative on the board.

WARREN B. WEEKS, district geologist for the Phillips Petroleum Company in El Dorado, Ark., addressed the Shreveport Geological Society last week on "Stratigraphy and Lithology of the Pre-Gulf Subsurface Strata in South Arkansas." The subject will be covered in a paper by Mr. Weeks at the A.A.P.G. meeting in New Orleans.

L. T. BARROW, head of the geological department of the Humble Oil & Refining Company, was elected a vice president at the company's annual meeting of stockholders. R. E. SEAGLER was named general attorney, a new office. JAMES S. CRATE, assistant secretary and treasurer, was named secretary and assistant treasurer; O. F. CARROLL, assistant treasurer, and B. P. BARRETT, JR., assistant cashier.

Do You Remember?

From The Oil and Gas Journal Files

25 YEARS AGO

James Andrew Moffett, vice president of the Standard Oil Company of New Jersey, dies at Palm Beach, Fla., after a brief illness. He rose from a clerkship to president of all the Standard's eastern pipe lines. His father was a surgeon, 49th Virginia regiment, in Gen. Robert E. Lee's army.

John J. Fisher, 76, dies in St. Petersburg, Fla. He was one of three brothers who formed the Fisher Oil Co., big operators, and shippers of oil from 1862 until the advent of pipe lines.

Al E. Watts resigns from the Oil Well Supply Company to direct the affairs of the Independent Oil & Gas Producers of Oklahoma, recently organized.

20 YEARS AGO

Julius Fohs, geologist, offers to supply 15 per cent of the cost of a new reformed Hebrew temple in Tulsa, which is being promoted by the energetic Rabbi Menkes. The temple will cost $50,000.

Chauncey F. Lufkin, 84, dies in Lima, Ohio. He occupied managerial positions with Standard Oil companies for 50 years. His son, E. C. Lufkin, is president of the Texas Company.

William McKendree Page, 62, one of the incorporators of the Ohio Oil Company and later of the Romano-Americano Oil Company in Rumania, dies in Winchester, Ky.

10 YEARS AGO

Dexter, Kans., has the only plant in the world devoted to the commercial production of helium. Another plant in Texas is government-owned.

West Texas production is 310,000 barrels per day and in the Seminole field, in Oklahoma, 308,000 barrels per day.

Reagan County, Texas, oil camps are being beautified by a professional landscape gardener engaged by the oil companies. Roses in the desert!

J. C. TUCKER, district superintendent in the East Texas field for the Atlantic Refining Company, has been transferred to the Hardin field, Liberty County, Texas Gulf Coast.

JOHN H. BURNS, secretary-treasurer of the Texas Crusader Oil Company, Houston, Tex., has been elected vice president, which position he will fill in addition to his former one.

J. A. McDONALD, chief scout and production representative of the Shell Oil Company in Los Angeles, Calif., for 18 years, has resigned to enter private business. He is succeeded by WILLIAM N. HARROD, formerly his assistant.

WALLACE A. BELSTOM, who recently resigned as vice president of the Mills Bennett Production Company to devote his time to independent operations, has returned to Houston, Tex., from an extended vacation visit in Minneapolis, Minn., his former home.

EDGAR H. STRONG, accountant, was chosen president of the Amerada Employes' Association, recently organized for social purposes in the offices of the Amerada Petroleum Corporation, Tulsa, and its subsidiary, the Geophysical Research Corporation. HARRIET G. BRAY was made secretary and CLAYTON N. WINN treasurer.

DR. SYLVAIN PIRSON, head of the petroleum and natural gas engineering department of Pennsylvania State College, has announced that the seventh annual oil and natural gas conference sponsored jointly by the college, the Pennsylvania Grade Crude Oil Association, and the Pennsylvania Natural Gas Men's Association, will be held at State College May 27-28.

PARAGRAPHS

JACK LEVERING, of the Stanolind Oil & Gas Company's scouting department, has been transferred from the Tulsa office to Houston, Tex.

D. OTY GROCE, of the Independent Oil Company, St. Charles, Mo., was reelected president of the Missouri Independent Oil Jobbers Association at the annual meeting in Kansas City. Other officers are W. R. McCAIN, Purity Oil Company, Springfield, vice president; J. M. THOMPSON, General Oil Products, De Soto, secretary; J. G. GIBSON, Capitol City Oil Company, Jefferson City, treasurer; R. B. HADLICK, Jefferson City, executive secretary.

W. H. SULLIVAN was elected president of the Gasoline Products Corporation, succeeding W. F. MOORE who resigned to join the purchasing department of the Texas Company. P. H. SULLIVAN was elected vice president and E. F. LIEBRECHT secretary. The new president was formerly vice president and treasurer. In addition to his new duties he remains treasurer.

MARVIN LEE has resigned as technical adviser of the Kansas State Corporation Commission, conservation division.

L. R. VESELY, geological scout for the Amerada Petroleum Corporation in Corpus Christi, Tex., will be transferred to Houston, Tex., March 1.

W. E. BROWN, petroleum engineer with the Tide Water Associated Oil Company, has been transferred from Conroe to the Kilgore office in East Texas.

H. R. CULLEN, president of the Quintana Petroleum Corporation, Houston, Tex., is general chairman of a campaign to raise more than $1,000,000 for buildings for the University of Houston.

JOHN DONNAN, Pittsburgh, Pa., consulting petroleum engineer, returned last week from Ecuador. He was accompanied on the trip, which consumed six weeks, by MRS. DONNAN.

G. S. WILLIAMS, veteran drilling superintendent of the Standard Oil Company of California, left California a few days ago as chief of the expedition organized by the Standard, Union Oil Company of California, and Tide Water Associated Oil Company to drill a deep test in the Salmon Creek-Bear Creek district in the southwestern Alaskan peninsula.

MRS. FRED T. MURPHY, San Francisco, is president of the Airlane Petroleum Corporation, which has begun operation of a new lubricating plant near Bakersfield, Calif. JOHN N. BAILEY, Bakersfield, is vice president; A. SENDERMAN, San Francisco, secretary-treasurer, and J. H. FULLER, San Francisco, general manager.

C. STUART MORGAN, secretary of the Near East Development Corporation, has returned to New York after spending several weeks in Europe. The Near East controls 23.75 per cent interest in the Iraq Petroleum Company, Ltd., and several other subsidiaries.

SEWELL C. HARLIN, Glasgow, Ky., was elected president of the Kentucky Petroleum Marketers Association at the annual convention in Louisville last week. Other officers chosen follow: Vice presidents, H. R. SMITH and A. J. SEHLINGER, both of Louisville; executive secretary, HERBERT L. CLAY, Louisville; directors, S. G. COURTNEY, Lexington, and W. F. GARDNER, Louisville. Holdover directors are C. E. BAUER, WILLIAM A. STOLL, T. O. BAUCUM, and PHIL T. WILLIAMS.

JOSEPH BICKING, in the scouting department of the Skelly Oil Company, has been transferred from Tulsa to Wichita, Kans. W. W. SIMPSON, formerly scout in Wichita, has been sent to Great Bend, Kans., replacing JAMES FORAKER, transferred to Hobbs, N. M.

J. E. MESSLER, of the H. P. Dunn Company, captured first prize in the contract division, and L. YAMPOLSKY, of the William Penn Oil Company, first in the auction division at the bridge party held in the Auditorium Hotel recently by the Chicago Oil Men's Club.

LLOYD I. YEAGER, Texas district geologist for the Cities Service Oil Company, has resigned and gone to Wichita, Kans., to engage in consulting work.

Rounding Out 25 Years

R. C. Stoner, general manager of the producing department of the Standard Oil Company of California and recently made a director to fill a vacancy created by the death of K. R. Kingsbury, president, will round out a quarter-century of service with the organization this year. Upon joining the Standard in 1913 Mr. Stoner was assigned to the geological division of the producing department in the home office in San Francisco. After four years there he was sent to the San Joaquin Valley as a petroleum engineer. In 1919 he returned to the home office, where he remained a year. Up to this time Mr. Stoner had geologized numerous structures in California, and in Montebello he mapped the location of the Standard's discovery well. He spent a year in the Rocky Mountain area, after which he was sent to Mexico, where from 1921 to 1924 he was manager of the company's geological and exploratory activities. Returning to San Francisco, he was made assistant general manager of the producing department. He was advanced in 1931 to general manager of the department, which post he has held since that time.

R. C. STONER

Mr. Stoner was born in Bakersfield, Calif., in 1889, and passed his boyhood there. Upon finishing high school in 1908 the young man entered the University of California, from which he graduated in 1912. The next year his association with the Standard of California began.

GEORGE RANKIN, petroleum engineer for Anglo-Ecuadorian Oilfields, Ltd., Guayaquil, Ecuador, stopped off in New York last week on his way to London, England, headquarters of the company.

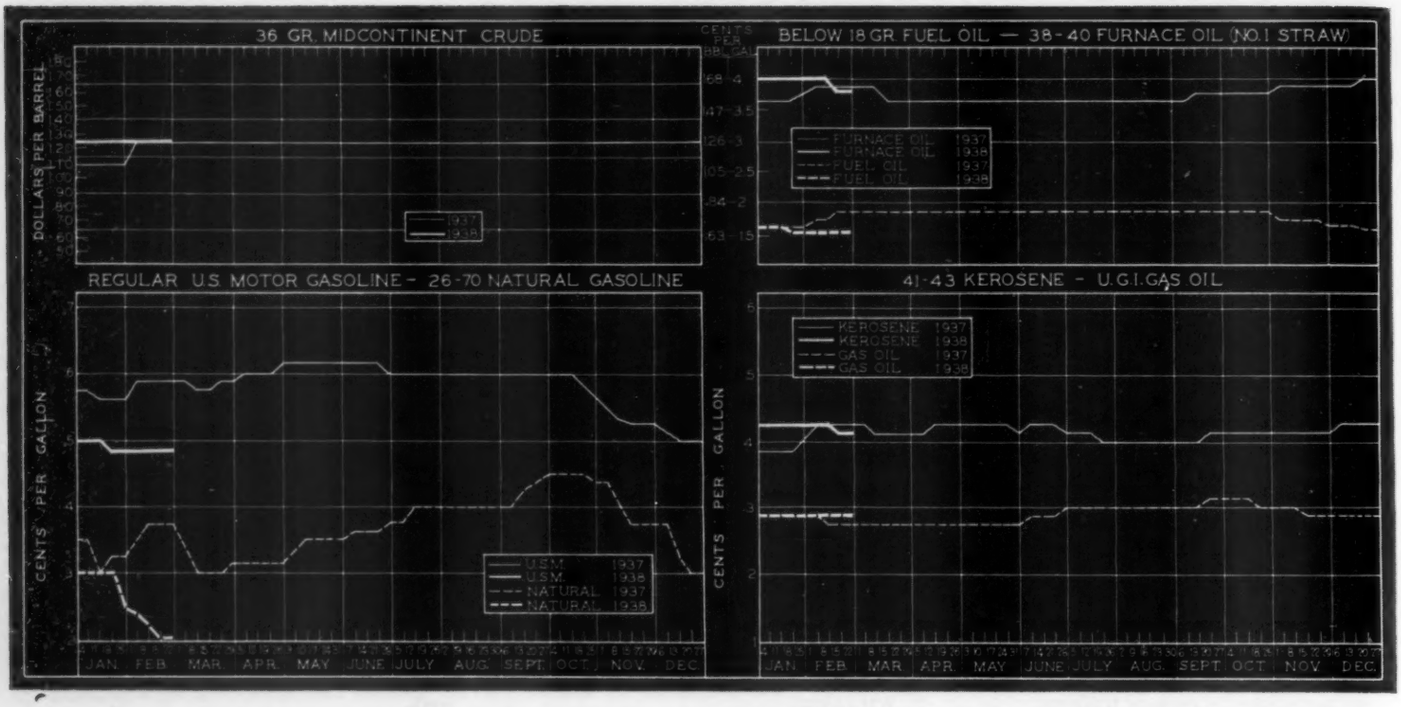
J. W. COLLINS has been promoted to field scout for the Phillips Petroleum Company in the Texas Panhandle, with headquarters in Amarillo, succeeding MAX L. DERRINGTON, resigned.

W. H. WETZEL, of the New York office of the Cities Service Company, in charge of all Mexico interests, stopped off for a one-day visit at the A.P.I. spring meeting in Amarillo, Tex., last week.

J. A. LaFORTUNE, vice president of the Warren Petroleum Company and affiliated organizations, has been appointed chairman of the natural gasoline committee for the International Petroleum Exposition, to be held in Tulsa next May.

H. G. BONNER, of Knoxville, Tenn., was elected president of the Southern Gas Association at a session in Dallas, Tex., last week. W. H. McINNIS, of Memphis, and JENNINGS YOUNG, of Tulsa, were elected vice presidents, and S. L. DRUMM was reelected secretary-treasurer.

BYRON MEREDITH, of the Sinclair Prairie Oil Company, Troup, Tex., was elected chairman of the East Texas chapter, American Petroleum Institute, in Kilgore last week. Vice chairmen chosen are R. M. BRADBURY, Houston Oil Company; M. W. McVEY, independent operator, and M. L. BROWN, Sun Oil Company. W. S. MORRIS, of the East Texas Engineering Association, was made secretary-treasurer.



Representative Mid-Continent Quotations on Crude Oil and Refined Products, Basis Oklahoma (Group 3)

Gasoline Market Continues to Record Improvement in Group 3 Territory

By T. F. SMILEY

Gasoline in the Group 3 area continued this week to show signs of the gradual recovery which began a month ago. Natural gasoline, which had been in a state of panic, was steadier. Heating oils were no better, but nobody expected them to be.

Much of the rising strength in gasoline issued from East Texas, where wholesale shutdowns have created actual scarcity. Refiners still operating in that area who last week raised their price for low-octane material to 4⅛ cents a gallon were holding the product still more closely this week, and few were willing to consider anything under 4¼ cents.

General Improvement Seen

Shutdowns were imparting a firmer tone to the higher-octane brackets, not only in East Texas but throughout the whole Mid-Continent. The grade exhibiting the most pronounced strength was the 63-66. Little of it is made outside of East Texas, and owing to idle plants buyers were having difficulty in filling their needs. Some East Texas refiners who had been selling it at 4⅜ cents are naming 4½ as the minimum now. The 67-69 also was in more active demand.

More gasoline is moved in the spot market by independents than by the majors, so that it generally is accepted as a fact that the independents make the market. The refineries which have been closing are those of independents, and each shutdown has freshened the open-market business, in some degree at least, for plants still running. Underselling virtually has disappeared, and a growing number of refiners now name quotations on a take-it-or-leave-it basis.

Additional shutdowns include those of the Bell Oil & Gas Co., at Gladewater, and Danciger Oil & Refineries, Inc., at Longview. The Bell plant has a daily crude capacity of 4,500 bbls. and a 2,000-bbl. cracking unit. The Danciger plant has a daily crude capacity of 6,500 bbls. and a 4,000-bbl. cracking unit. The Shell Petroleum Corp. announced it had reduced runs to stills about 10 per cent at its plants in East Chicago, Ind.; Arkansas City, Kans.; Norco, La., and Wood River, Ill.

At least two dragons remain in the path of the gasoline market. One is the nation's stocks, soaring to astronomical heights. The other, much less formidable, is the abnormally low price of natural gasoline, which brings that material into competition with the refinery product.

In the natural gasoline trade it was believed prices had reached bottom. As a result of their sharp descent jobber buying was said this week to have attained unprecedented volume. Demand for 12- and 14-pound was exceedingly active. In the extreme north the 12-pound is used straight as a motor fuel. The 14-pound is blended with a low-octane refinery product. In either case the jobber gets a middle-bracket fuel for less than third-grade refinery gasoline would cost.

Jobber demand in Oklahoma and Kansas was reported to be absorbing all the current production offered in the spot market and all that from the Texas Panhandle available for shipment in tankcars.

Trying to Move Heating Oils

Quiet efforts of refiners to get rid of unwieldy inventories of heating oils were observable this week. These took the form of giving a higher-grade material than the price called for, rather than straight-out price cuts. Snowfall and lower temperatures in scattered areas stirred hope of livened demand, but no real improvement developed from the weather. Closing of East Texas refineries which made substantial quantities of furnace oils helped to steady the market a little. More aggressive measures to move stocks are expected.

Both neutrals and bright stocks were draggy, the neutrals being especially weak. Stocks in all the lubricant groups were reported backing up. Heavy industrial fuel showed no improvement. Wax was increasingly hard to move.

Refined Oil Market Barometer

Distress gasoline stocks overhanging the market in refineries with limited storage facilities are shrinking as a result of shutdowns and reduced runs to stills. Total stocks, however, continue to soar. A mild winter has left many refiners with unwanted heating oils on their hands. Aggressive methods are being used to move these. Delay in spring demand for lubricants is softening prices.

MID-CONTINENT. Gasoline slightly stronger. Naturals improving. Heating oils easy.

EAST COAST. Cold snap giving furnace oils brief rally. Gasoline unsteady.

GULF COAST. General market in petroleum products dull, with prices unchanged.

CALIFORNIA. Gasoline, fuel oil, diesel, and kerosene distillate headed downward.

PENNSYLVANIA. Gasoline and fuel oils soft. Lubricants barely holding.

CHICAGO. Jobbers looking for pickup in gasoline. Range oil demand brisk.

Another Bulge in Fuel Oil Market Developed by Wintry Weather

By H. STANLEY NORMAN

NEW YORK, Feb. 22.—Another bulge in the fuel oil market developed last week when temperatures skidded below the freezing point for three or four consecutive days. There had been no change in the tankcar market of 5 cents per gallon during the week or more of warm weather during which terminal stocks backed up but concessions in the tank-wagon selling had been reported frequently. Tapering off in fuel oil demand in this section due to the more clement weather had been reflected as far south as the Gulf Coast, but largely in the tanker charter market rather than in the quotations for products. With several boats idle in Gulf Coast waters and seeking charter voyages, the rates asked dropped a cent or two per gallon on both clean and dirty bottoms.

Tankcar quotations on 65 octane gasoline in the New York harbor spot market ranged from 6½ to 7 cents per gallon with some suppliers still asking 7¼ cents at New Jersey refineries for the New York trade. Ample supplies were reported available at the lower range of quotations. There are only limited quantities of gasoline moving on the spot market. The bulk of current motor fuel business is moving under contracts in most cases at prices slightly above the low range of the current spot quotations which are subnormal even for this season.

Refiners and marketers generally expect the spot market to strengthen in the next few weeks for a dual reason. In the first place, diminishing volumes of gasoline in the spot market "distress" classification probably will result from the cessation of operations by several plants in East Texas. In the second place, export buying is about due for another bulge since activity has been at a low level for three weeks or a month. Since December, export buying has traveled in a rather uniform cycle with extremely intense activity followed by proportionate lulls. Buyers have been inactive for about the maximum period permitted by their commitments abroad and are expected to reappear in the market shortly to cover April and May requirements.

Some of the distress gasoline which has pushed the Gulf Coast market downward and in turn depressed prices up and down the entire Atlantic seaboard probably will be permanently removed in the course of normal business during the next few weeks. Shutdown plants at inland Texas points probably will not resume operations until reasonable assurance is evident that a substantial period of running time will be possible.

There appeared to be no alarm in oil circles of New York last week over the announcement of the Department of Justice that an investigation of crude oil prices had been launched to determine whether provisions of the antitrust law were being violated. With respect to the stable crude market, qualified oil men made the observation that several of the companies are willing and able to purchase allowable production from their various producer connections. In anticipation of another record consuming year, they assert it would be folly to reduce their crude connection (a result which might naturally follow a shuffle of prices), when the summer's requirements might precipitate a shortage. In other words, they say, what now appears a questionable business policy of maintaining crude prices at or near the price returned by products may prove to be an extremely sound policy later in the year. In most instances the large buyers of crude oil, who naturally are regarded as leaders of the market, are currently buying for midsummer or fall requirements. Most of them could cease buying crude today and operate for several months but at the expense of draining their lines and storage tanks and leaving them empty handed for continuation of business. Along another line of reasoning, a majority of oil men feel that nothing whatever is preventing the independent refiners from reducing their posted crude prices, but that the incentive is largely withdrawn because of their inability to dispose of products even at concession prices.

Retail gasoline prices in the New York marketing district were subjected to occasional outbreaks of decline during the week. A disturbed area centered in Queens Borough and had invaded the upper east side of Manhattan where some stations were quoting 95 to 98 cents for 5 gallons. Across the Hudson River, New Jersey prices were still on unsound ground with quotations ranging from 13.9 cents per gallon up to 15.9 cents. The lower prices prevailed mostly along the vehicular traffic arteries leading to and from New York and were based purely on a bid for volume at lower dealer margins. The tank-wagon and tankcar price in New Jersey has been unchanged as in New York, although basically a quarter of a cent per gallon lower on the western side of the Hudson River.

Kerosene activity was stimulated slightly last week by the colder weather in this immediate section and up-state New York agricultural districts. Operators of space heaters were ordering out supplies throughout the week to meet demands of colder weather. Tankcar prices are unchanged at 6 cents per gallon, but small quantities offered at lower figures largely disappeared when the thermometer dropped below the freezing point.

High octane gasoline was also reasonably active in the western Pennsylvania refining district along with kerosene. Fuel oil activity slumped because of competition from Michigan in western Ohio and small quantities of material were reaching even into western Pennsylvania.

Deliveries against contracts and to make up export cargoes purchased in January maintained the Pennsylvania lubricating oil market on the preceding week's stronger basis, but new business entering the district was only moderately satisfactory.

Wax prices at Pennsylvania plants and at the New York harbor terminals were continuing downward. Crude scale was reported available in some quarters at 2.1 cents per pound with the upward range stopping at 2.2 cents per pound. Stocks at most points are reported heavy and buyers are still disinterested.

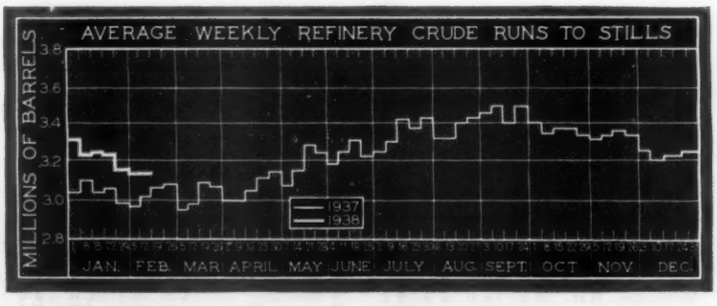
Dullness of the Gulf Coast market prevailing since the third week in January continued. Export interests are still holding out of the market seeking further price concessions while the decline is unchecked. As in the past, business in this direction probably will be delayed as long as possible. Lack of activity extended to the domestic coastwise trade although movement against contracts in practically all products, with the possible

(Continued on Page 280)

A. P. I. Weekly Refinery Statistics

Week Ending February 19, 1938

Refinery figures for week ended February 19 not available, due to Washington Birthday Holiday



Stocks of Crude Oil in the United States

(BUREAU OF MINES ESTIMATES)

Week ending February 12, 1938	304,915,000 barrels
Week ending February 5, 1938	304,494,000 barrels
Week ending February 13, 1937	287,877,000 barrels

Retail Oil Markets

Tank-wagon and filling station prices on gasoline and kerosene furnished by the larger marketing firms

Prices as of February 22, 1938

Taxes

The gasoline quotations given in the following tables include the 1-cent federal tax, as well as state, county and city taxes. The gasoline is the regular or standard grade. In most areas a third grade and a premium grade are also available.

Standard Oil Co. (Indiana)

	Gasoline Tank wag.	Dlr.	Inc. tax	Kero. tank wag.
Chicago, Ill.	15.3	13.3	4.0	10.2
Decatur	15.3	13.1	4.0	10.2
Joliet	15.3	13.8	4.0	10.2
Peoria	15.3	13.8	4.0	10.2
Quincy	15.1	13.6	4.0	10.0
Davenport, Ia.	15.3	13.8	4.0	‡13.2
Des Moines	15.1	13.6	4.0	‡11.0
Mason City	15.4	13.9	4.0	‡13.3
Sioux City	15.3	13.8	4.0	‡13.2
Duluth, Minn.	17.0	15.5	5.0	10.9
Mankato	16.7	15.2	5.0	10.6
Minneapolis	16.7	15.2	5.0	10.6
Lacrosse, Wis.	16.7	15.2	5.0	10.6
Green Bay	17.0	15.5	5.0	9.9
Milwaukee	16.5	15.0	5.0	10.4
Detroit, Mich.	15.1	13.6	4.0	9.8
Grand Rapids	16.3	14.8	4.0	11.0
Saginaw	16.1	14.6	4.0	9.1
Evansville, Ind.	16.8	15.3	5.0	†10.7
Indianapolis	16.9	15.4	5.0	†10.8
South Bend	17.2	15.7	5.0	9.0
Fargo, N. Dak.	16.7	15.2	4.0	11.6
Minot	17.9	16.4	4.0	12.8
Huron, S. Dak.	17.1	15.6	5.0	11.0
Kans. City, Mo.*	14.6	13.1	4.0	9.5
St. Louis*	14.9	13.4	4.0	9.8
St. Joseph	14.6	13.1	4.0	9.5
Wichita, Kans.*	14.1	11.0	4.0	7.0

*State tax 2 cents, 1-cent city tax and 1-cent federal tax. †Does not include 4-cent state tax. ‡Iowa kerosene prices include 3-cent state tax.

(Exclusive of state general sales taxes, except Indiana and South Dakota.)

Discounts to commercial consumers: On purchases per month off tank-wagon prices: 1,000 gallons or more, 1.5 cents off; minimum delivery 25 gallons.

Stanolex Fuel Oil in Chicago

Effective Dec. 7, 1936, f.o.b. Chicago tank-wagon prices: Range oil, 1-99 gallons, 8.8 cents; 100-149 gallons, 7.8 cents; 150 gallons and over, 7.3 cents. Stanolex No. 1, 1-99 gallons, 8.8 cents; 100-149 gallons, 7.8 cents; 150 gallons and over, 7 cents. Stanolex furnace oil, 1-149 gallons, 7.8 cents; 150 gallons and over 7 cents; Stanolex A, 1-399 gallons, 5.75 cents; 400 gallons and over, 4.75 cents. Stanolex B, 1-799 gallons, 5.75 cents; 800 gallons and over, 4.75 cents.

Atlantic Coast District

STANDARD OIL CO. OF NEW JERSEY

	Gasoline Tank-wag. dlr.	Tank-car con'r.	Inc. tax	Kero. tank wag.
Atl tic, City, N. J.	12 75	11.25	4.0	8 5
Newark	12 75	11 25	4 0	8 5
Annapolis, Md.	14 85	13 35	5 0	9 5
Baltimore	14 25	12 75	5 0	9 0
Cumberland	16 65	14.15	5 0	10 0
Wash'g'n, D. C.	12 5	11.0	3 0	9 5
Danville, Va.	17.45	14 95	6 0	12 0
Norfolk	16 25	13 75	6 0	11 5
Petersburg	16 55	14 05	6 0	11 7
Richmond	16 55	14 05	6 0	11 7
Roanoke	17 75	15.25	6 0	12 9
Charles'n, W. V.	17.05	14 55	6 0	12 6
Parkersburg	15 35	13 85	6 0	11 2
Wheeling	16 25	14 85	6 0	12 2
Charlotte, N. C.	18 65	16 15	7 0	12 6
Hickory	19 15	16 65	7 0	13 0
Mt. Airy	18 95	16 45	7 0	12 8
Raleigh	18 25	15 75	7 0	12 1
Salisbury	18 75	16 25	7 0	12 7
Charleston, S. C.	17 25	14 75	7 0	11 1
Columbia	18 25	15 75	7 0	12 1
Spartanburg	18 95	16 45	7 0	12 9

Price basis to commercial consumers, effective March 8, 1937, in Maryland, District of Columbia, and in Arlington and Fairfax counties in Virginia; and March 12 in New Jersey: To contract accounts purchasing at least one full compartment at time by hose connection, on yearly purchases: From 2,500 to 100,000 gallons, consumer tank-wagon price at time and place of delivery; 100,000 gallons per year, consumer tankcar price plus .5 cent per gallon. Consumer tank-wagon price generally will be equivalent to dealer tank-wagon price less .5 cent per gallon.

Effective May 15, 1937, in North and South Carolina, West Virginia and Virginia (except Arlington and Fairfax counties): Commercial consumers taking deliveries of 50 gallons (W. Va., 100 gallons) or more at one time will be billed at posted consumer tank-wagon price. Accounts taking deliveries of less than 50 gallons (W. Va., 100 gallons) will be billed at 4 cents per gallon over posted consumer tank-wagon price. Generally the posted consumer tank-wagon price will be the equivalent to the dealer price less .5 cent per gallon.

Discount for kerosene, 1 cent off tank-wagon price for 25 gallons or more under contract (contract not necessary in Baltimore) except no discount in New Jersey.

Southern District

STANDARD OIL CO. OF KENTUCKY

	Gasoline Tank-wag.	Net dlr.	Inc. tax	Kero. tank wag.
Atlanta, Ga.	21 0	18 0	7 0	*†14 0
Augusta	21 0	18 0	7 0	*14 0
Macon	21 0	18 0	7.0	*14 0
Savannah	19 5	16 5	7 0	*12 0
Birm'ham, Ala.	22 0	19 0	8 0	12.0
Mobile	21.0	18.0	9.0	†11.0
Montgomery	22 0	19 0	9 0	†13 0
Jackson, Miss.	20 0	17 0	7 0	*13 0
Vicksburg	20 0	17 0	7 0	*13 0
Jacks'ville, Fla.	22 5	17 5	8 0	†11 0
Miami	20 5	17 5	8 0	†12 5
Pensacola	22 0	19 0	9 0	12 0
Tampa	20 5	17 5	8 0	10 5
Lexington, Ky.	19 5	16 5	6 0	11 0
Covington	18 5	15 5	6 0	11 0
Louisville	19 0	16 0	6 0	10 5
Paducah	19 5	16 5	6 0	10 0

Price basis to tank-wagon consumers: Effective January 4, 1937, 3 cents per gallon below tank-wagon price. Kerosene prices in all states subject to 2 cents discount except in Kentucky where prices are net.

*Includes 1-cent state tax. †Subject to 2-cent discount.

Montgomery, Ala., has a county tax of 1 cent per gallon, and a city tax of 1 cent per gallon on gasoline, in addition to state tax; and 1 cent per gallon on kerosene. Mobile, Ala., has a city gasoline tax of 2 cents per gallon; Birmingham, Ala., has a city gasoline tax of 1 cent per gallon; Pensacola has a city gasoline tax of 1 cent.

Rocky Mountain District

CONTINENTAL OIL CO.

	Gasoline Dealer	Inc. tax	Kero. tank wag.
Denver, Colo.	15 0	5 0	11 5
Grand Junction	19 0	5 0	15 0
Pueblo	13.0	5.0	10.5
Casper, Wyo.	17 0	5 0	11 5
Cheyenne	16 0	5 0	13 0
Butte, Mont.	19 5	6 0	15 5
Billings	19 5	6 0	15 5
Helena	19 5	6 0	15 5
Great Falls	19 5	6 0	15 5
Salt Lake City, Utah	19 5	5 0	16 0
Twin Falls, Ida.	21 0	6 0	18 0
Boise	21 5	6 0	18 0
Albuquerque, N. M.	17 5	*6 5	12 0

*Includes city tax of one-half cent.

Ohio

STANDARD OIL CO. OF OHIO

	Gasoline Tank-wag.	Di-vided con'r.	Inc. dlr.	Inc. tax	Kero tank wag.
Ohio points	16 0	15 00	5 0	*13 0	

*Includes state tax of 1 cent.

New York and New England

SOCONY-VACUUM OIL CO., INC.

	Gasoline Tank-wag. dlr.	Tank-car con'r.	Inc. tax	Kero. tank wag.
Albany, N. Y.	14 5	12 5	5 0	9 0
*Met. N. Y.:				
M'nh't'n, Br'nx	14 5	12 5	5 0	8 75
Staten Island	14 5	12 5	5 0	8 75
Q'ns. & Brklyn	14 5	12 5	5 0	8 75
Buffalo	14 0	13 04	5 0	7 5
Rochester	15 0	13 17	5 0	8 5
Syracuse	14 5	13 12	5 0	9 0
Boston, Mass.	13 0	11 5	4 0	8 5
Portland, Me.	14 5	12 7	5 0	8 75
Manch'ter, N.H.	15 0	13 0	5 0	9 0
Burlington, Vt.	14 9	12 9	5 0	9 5

*Does not include 2 per cent city sales tax which is calculated on basis of net retail price exclusive of state and federal taxes.

Price basis to undivided dealer: Posted dealer tank-wagon price less .5 cent. Price basis to commercial consumer. Effective Nov. 15, 1936, monthly purchases of 25,000 gallons and over, consumer tankcar prices at delivery point plus .5 cent per gallon; monthly purchases of 5,000 to 25,000 gallons, undivided dealer price at delivery point; monthly purchases under 5,000 gallons, pay divided dealer tank-wagon prices at delivery point.

Pacific Coast Territory

STANDARD OIL CO. OF CALIFORNIA

	Gasoline Tank-wag.	Serv. sta.	Inc. tax	Kero. tank wag.
San Francisco	17 5	18 5	4 0	11.5
Los Angeles	17 0	18 0	4 0	10 0
Fresno, Calif.	18 5	19 5	4 0	12 5
Phoenix, Ariz.	21 0	22 0	6 0	*17 0
Reno, Nev.	20 0	21 0	5 0	13 0
Portland, Ore.	20 0	21 0	6 0	13 5
Seattle, Wash.	20 0	21 0	6 0	13 5
Spokane	22 5	23 5	6 0	16 0
Tacoma	20 0	21 0	6 0	13 5

*Includes 5-cent state tax.

Discounts to dealers: On gasoline, off tank-wagon price, to 100 per cent dealers, 3 cents; to split dealers, 2 cents. To commercial consumers: on tank-wagon price: on single deliveries of 40 gallons and over, advance quantity discount extended at time of delivery, 3 cents. Service station schedule applies on single deliveries less than 40 gallons. On kerosene in tankcar, transport truck and trailer delivery, 3 cents off tank-wagon price; plant deliveries to jobbers, 2.5 cents below tank-wagon.

Nebraska

STANDARD OIL CO. OF NEBRASKA

	Gasoline Tank wag.	Drl.	Inc. tax	Kero. tank wag.
Omaha	17 7	16 2	6 0	10 5
McCook	17 5	13 5	6 0	10 0
Norfolk	18 1	16 6	6.0	10.9
North Platte	18 5	17 0	6 0	11 3
Scotts Bluff	19 2	16 0	6 0	12.0

Discounts to commercial consumers for tank-wagon deliveries covered only by standard commercial consumers contract, effective Jan. 1, 1935.

Central South District

STANDARD OIL CO. OF LOUISIANA

	Gasoline Tank-wag. dlr.	Tank-car con'r.	Inc. tax	Kero. tank wag.
N. Orleans, La.	19 0	16 5	*10 0	†12 0
Baton Rouge	17 0	14 5	8.0	12 0
Alexandria	17 5	15.0	8 0	10.5
Lafayette	18 0	15 5	8.0	12.5
Lake Charles	18 0	15 5	8 0	12.5
Shreveport	16 5	14 0	8.0	9.5
Kn'ville, Tenn.	20 0	17 5	8 0	14 0
Memphis	18 0	15.5	8.0	12.0
Chattanooga	19 5	17 0	8.0	13.5
Nashville	19 0	16 5	8 0	11.5
Bristol	19.5	18.25	8.0	14.5

*Includes 2-cent parish tax. †Includes 1-cent parish tax and 1-cent state tax.

Price basis to commercial consumers: Effective May 15, 1937, deliveries of 50 gallons or more in one delivery takes posted consumer tank-wagon price. Accounts taking deliveries of less than 50 gallons at one time pay posted consumer tank-wagon price plus 4 cents per gallon. Generally, the posted consumer tank-wagon price will be equivalent to the dealer price less .5 cent per gallon.

Louisiana kerosene prices include 1-cent state tax.

Pennsylvania, Delaware and Part of New England

ATLANTIC REFINING CO.

	Gasoline Tank-wag. dlr.	Tank-car con'r.	Inc. tax	Kero. tank wag.
Philadelphia, Pa.	13 25	11.75	5.0	10.5
Pittsburgh	15 0	13 0	5 0	11 0
Allentown	14 25	12 75	5 0	11 0
Erie	14 5	13 0	5 0	10 0
Scranton	14 5	13 0	5 0	11 0
Altoona	15 0	13 0	5 0	11 0
Dover, Del.	14 0	....	5 0	11 0
Wilmington	14 0	....	5 0	11 0
Springf'd, Mass.	13 5	....	4.0	8 5
Worcester	14 3	....	4 0	9 0
Hartford, Conn.	13 6	....	4 0	8 5
New Haven	13 5	....	4 0	8 0
Providence, R. I.	13 3	....	4 0	8 5

Price basis to undivided dealers, dealer tank-wagon price less .5 cent per gallon. Price basis to commercial consumers in Pennsylvania and Delaware, effective March 11, 1937: Consumers under contract using 100,000 gallons or more per year full compartment hose deliveries, tankcar plus .5 cent. Consumers under contract using less than 100,000 gallons per year compartment hose deliveries, undivided dealer price. Consumers under contract less than full compartment delivery, consumers not under contract less than full compartment delivery, and consumers not under contract full compartment delivery, divided dealer price. Less than 25 gallons, tank-wagon delivery, 4 cents per gallon above undivided dealer price.

Oklahoma and Arkansas

CONTINENTAL OIL CO.

	Gasoline Dealer	Inc. tax	Kero. tank wag.
Muskogee, Okla.	14 5	5 0	7.0
Oklahoma City	14 0	5 0	8.0
Tulsa	14 0	5.0	6.0
Ft. Smith, Ark.	14 75	5 0	8.0
Little Rock	17 25	7 5	9.5
Texarkana	14 0	5 0	8.5

Texas

	Gasoline Tank-wag.	Serv. sta.	Inc. tax	Kero. tank wag.
Dallas, Tex.	15.0	19 0	5.0	8.0
Fort Worth	14 0	18 0	5 0	8 0
Houston	14 5	19 0	5 0	8 0
San Antonio	14 5	18.5	5.0	8.0

Naphtha

STANDARD OIL CO. (INDIANA)

	Tank-wagon*
Oleum spirits	15 7
V.M.&P. naphtha	16 0
Cleaners' naphtha	15 0
Stanisol	15 0

*Prices include 3-cent Illinois tax, but not 1-cent federal tax or 2 per cent retail occupational tax.

Prices f.o.b. Chicago. Each price subject to discount of 1 cent per gallon for 150-gallon lots if covered by contract.

Canada*

3 Star Imperial Gasoline
IMPERIAL OIL, LTD.

	Tank-wag.	Inc. tax	Kero. tank wax.
Halifax, N. S.	24 0	8 0	18 5
St. John, N. B.	24 0	8 0	18 5
Montreal, Que.	21 0	6 0	17 5
Toronto, Ont.	22 0	6 0	17 0
Hamilton, Ont.	22 0	6 0	17 0
Winnipeg, Man.	27 5	7 0	20 7
Brandon, Man.	28 1	7 0	22.3
Regina, Sask.	27 0	7 0	22 0
Saskatoon, Sask.	29 8	7 0	24.9
Edmonton, Alta.	26 5	7 0	21.5
Calgary, Alta.	24 0	7 0	19.0
Vancouver, B. C.	23 0	7 0	23.0

*Imperial gallon used in Canada.

Divided dealers pay tank-wagon price. Discount to undivided dealers, 1 cent below tank-wagon price. In maritime provinces both divided and undivided dealers pay tank-wagon price.

Retail Price Changes

Standard Oil Co. (Indiana) February 12 reduced tank-wagon kerosene **1.5 cents** in Wichita.

Standard Oil Co. of Louisiana February 15 reduced consumer tankcar and **dealer** gasoline .75 cent at all points in **Louisiana** and Tennessee except no change at Bristol.

New York Market

(Continued from Page 279)

exception of light and heavy fuel oils, is about normal for the season. Spot cargo business has been held at a low level with prices drifting accordingly into lower ground.

There was an upswing last week in the chartering activity of tankers for foreign voyages originating in the Dutch West Indies or on the Gulf Coast. Rates have declined slightly both for foreign and coastwise traffice during the past two weeks. A vessel was reported chartered for movement of light crude oil from the Gulf Coast to north of Cape Hatteras last week at 33 cents per barrel. The latest fixture reported for transporting clean products was at 37 cents per barrel.

The rates for foreign traffic ranged from 21 shillings for steamers loading in the Dutch West Indies or on the Gulf Coast up to 27 shillings 6 pence for motor ships available immediately.

Prices of Refined Products

All quotations f.o.b. plant in cars for interstate or export movement except as otherwise noted

Prices as of February 22, 1938

The following quotations are exclusive of the federal excise taxes of 1 cent a gallon on gasoline and 4 cents on lubricating oils.

Refinery Gasoline

OKLAHOMA (Group 3)—

U. S. Motor grades:		
62 oct. and below	.03⅞	.04
63-66 octane	.04⅜	.04½
67-69 octane	.04⅝	.04⅞
70-72 octane (regular)	.04⅞	.05
60-62 400 grades:		
62 oct. and below	.03⅞	.04
63-66 octane	.04⅜	.04½
67-69 octane	.04⅝	.04⅞
70-72 octane (regular)	.04⅞	.05
64-66 375	.04½	.04¾
68-70 360	.04⅞	.05⅛

NORTH TEXAS—

U. S. Motor grades:		
62 octane and below		.04
63-66 octane	.04⅜	.04½
67-69 octane	.04⅝	.04⅞
70-72 octane (regular)	.04⅞	.05
60-62 400	.03⅞	.04
64-66 375	.04½	.04¾

NORTH LOUISIANA (Ark., N. La. and Miss. delivery)

U. S. Motor grades:		
62 octane and below	.04½	.04⅝
63-66 octane	.04⅝	.04¾
67-69 octane	.05	.05⅛
70-72 octane (regular)		.05½

ARKANSAS (Ark., N. La., Miss. del.)—

U. S. Motor grades:		
62 octane and below		.04½
67-69 octane	.05	.05⅛
70-72 octane (regular)	.05½	.05⅝

CHICAGO (Based on Group 3)—

U. S. Motor grades:		
62 octane and below	.04	.04¼
63-66 octane	.04⅜	.04⅜
67-69 octane	.04⅝	.04⅞
70-72 octane (regular)	.05	.05¼
60-62 400 grades:		
62 octane and below	.04	.04¼
63-66 octane	.04⅜	.04⅜
67-69 octane	.04⅝	.04⅞
70-72 octane (regular)	.05	.05¼
64-66 375	.04¾	.05
68-70 360	.05	.05¼

PENNSYLVANIA (Inland refineries)—

58-60 U. S. Motor:		
Below 60 octane	.04½	.05
65 octane	.06¼	.06⅜
68-70 octane	.06¾	.07½

CALIFORNIA (domestic movement)—

54-58 U. S. Motor	.07	.08½
58-60 400, 65 oct. and higher	.08	.09¼

EAST COAST (Domestic)—

U. S. Motor, 60-64.9 octane:		
New York (Bayonne)	.07	.07¼
Philadelphia	.07	.07¼
Boston	.07½	.07⅝
Baltimore	.07	.07¼
Charleston, S. C.	.07	.07¼
U. S. Motor, 65 and above:		
*New York (Bayonne)	.07½	.07⅝
Philadelphia	.07½	.07⅝
Boston	.07¼	.07⅝
Baltimore	.07½	.07½
Charleston, S. C.	.07⅝	.08

*All grades of gasoline one-eighth to one-fourth cent less for barge shipments. New York harbor prices are for New York and New England delivery. Prices for New Jersey delivery one-fourth cent lower.

GULF COAST (domestic)—

U. S. Motor grades:		
Below 60 octane	.05	.05⅛
60-64.9		.05¼
65 octane and higher	.05½	.05⅝

Naphtha

PENNSYLVANIA (Inland refineries)—

52-56 450 (blending)	.04½	.04¾

Natural Gasoline

OKLAHOMA (Group 3)—

Grade 26-70		.02
Grade 18-55	.02⅜	.02½

NORTH TEXAS—

Grade 26-70		.01⅜
Grade 18-55	.02⅛	.02⅜

CALIFORNIA—

75-85 375-390	.06½	.07½

NORTH LOUISIANA (Ark., N. La. and Miss. delivery)—

Grade 26-70	.02⅛	.02⅛

Tractor Fuel

OKLAHOMA (Group 3)—

40-42 gr., 315-325 l.b.p., 110 flash, 540-550 e.p.	.04⅛	.04¼
41-43 gr., 300-520 e.p., 110-125 flash, 500-520 e.p.	.04¼	.04⅜
46-48 gr., 210-230 l.b.p., 480 max. e.p.	.04⅝	.04¾

Kerosene

(All kerosene water white)

OKLAHOMA (Group 3)—

41-43	.04⅛	.04¼
42-44	.04¼	.04⅜

NORTH TEXAS—

41-43	.04⅛	.04¼

NORTH LOUISIANA (Ark., N. La. and Miss. delivery)—

41-43	.04⅜	.04½

ARKANSAS (Ark., N. La., Miss. del.)—

41-43	.04½	.04⅝

PENNSYLVANIA (Inland refineries)—

45	.05⅜	.05½
46	.05½	.05⅝
47	.05⅝	.05¾

CHICAGO (Based on Group 3)—

41-43	.04⅛	.04⅜
42-44	.04⅜	.04⅝

CALIFORNIA (Pac. Coast market)—

38-43 high burning test	.05¾	.06¾

NEW YORK (Bayonne, N. J.)—

41-43		.06

***GULF COAST (domestic)—**

41-43	.04⅞	.05

*Barge price one-eighth cent lower.

Furnace Oil

OKLAHOMA (Group 3)—

No. 1 prime white, 38-42	.03⅞	.04
No. 1 straw, 38-40	.03¾	.03⅞
No. 2 straw, 32-36	.03⅝	.03¾
No. 2 dark, 32-36		.03⅝
No. 3 zero to 15, 28-32	.03⅜	.03⅝
No. 3, 15 and above, 28-32	.03	.03⅛

NORTH TEXAS—

No. 1 prime white, 38-42		.04
No. 1 straw, 38-40		.03⅞

NORTH LOUISIANA (Ark., N. La. and Miss. delivery)—

No. 2, 32-36		.03⅝

ARKANSAS (Ark., N. La., Miss. del.)—

No. 2, 32-36	.03⅞	.04

CHICAGO (Based on Group 3)—

No. 1 prime white, 38-40	.04⅛	.04¼
No. 1 straw, 38-40	.04	.04⅛
No. 2 straw, 32-36	.03⅞	.04
No. 2 dark, 32-36	.03⅝	.03⅞
No. 3, zero to 15, 28-32	.03½	.03⅝
No. 3, 15 and above, 28-32	.03	.03⅛

NEW YORK (Bayonne, N. J.)—

*No. 1		.06
*No. 2		.05¼
*No. 4		.05

*Barge deliveries one-eighth to one-fourth cent under above tankcar price.

Gas Oil and Fuel Oil

(Gas oil per gal.; fuel oil per bbl.)

OKLAHOMA (Group 3)—

U.G.I. gas oil	.02⅞	.03
No. 4, low cold test, 24-28	1.10	1.15
No. 4, 15 and above, 24-28	.90	.95
No. 5, low cold test, 18-22	.80	.85
Below 18 fuel oil, industrial	.65	.70

NORTH TEXAS—

U.G.I. gas oil	.02⅞	.03
No. 4, low cold test, 24-28	1.10	1.15
No. 5, low cold test, 18-22	.80	.85
Below 18 fuel oil, industrial	.65	.70

NORTH LOUISIANA (Ark., N. La. and Miss. delivery)—

10-14 fuel oil, industrial	.80	.85

CHICAGO (Based on Group 3)—

U.G.I. gas oil	.03	.03⅛
No. 4, low cold test, 24-28	1.10	1.15
No. 4, 15 and above, 24-28	.90	.95
No. 5, low cold test, 18-22	.80	.87½
No. 5, 15 and above, 18-22	.75	.82½
No. 6, low cold test, 10-16	.72½	.80
No. 6, 15 and above, 10-16	.55	.60

PENNSYLVANIA (Inland refineries)—

36-40	.04¾	.05⅛

CALIFORNIA

Los Angeles:		
30-40 gas oil, per bbl.	1.35	1.70
24 plus diesel, per bbl.	1.45	1.70
24 plus diesel (bunkers)	1.55	1.70
12-16 (bunkers at tidewater)	.90	1.00
10-16 (cargo lots)	.85	1.00
12-17 (tankcars)	.80	1.00
10-17 (high sulfur)	.65	.90
San Joaquin Valley:		
10-18 (tankcars)	.60	.85
24 plus diesel, per bbl.	1.40	1.70
San Francisco:		
24 plus diesel, per bbl.	1.55	1.70
24 plus diesel (bunkers)	1.60	1.70
10-16 (bunkers)	1.00	1.05

GULF COAST—

28-30 gas oil	.04⅛	.04¼
28-30 diesel (bunkers)		1.90
Bunkers (bulk cargoes)		.85
Bunker C (bunkers)	.90	1.05

NEW YORK (Bayonne, N. J.)—

27 plus, gas oil		.05
28-30 diesel (lighterage 6¼c per bbl.)		2.10
28-30 diesel (tankcars)		.05
Bunker C (to ocean-going ships in N. Y. harbor)		1.25
Industrial fuel (tankcars)	.04½	.04¾

Lighterage charge 5c bbl. additional.

Bright and Steam Refined

OKLAHOMA (Group 3)—

Bright Stocks:		
190-200 D, 15-25		.19
150-160 D, 0-10		.16
150-160 D, 15-25		.15
150-160 E, 15-25		.14½
100-110 D, 0-10		.14½
Steam refined:		
631 green (treated)		.13½
600 dark green (untreated)		.05

PENNSYLVANIA—

Bright Stocks (Pennsylvania Grade No. 8 color, 140-150 at 210, 545-550 flash):		
10 pour test	.18½	.19½
15 pour test	.17½	.18½
20 pour test	.16½	.17½
25 pour test	.15½	.16½
Steam refined:		
600	.08½	.09
650	.10½	.11½
600 Pennsylvania flash	.11	.13
630 flash	.14	.15
600 Warren E filtered	.13	.14

Neutral Oil

(Vis. at 100° F. except Pennsylvania and color N.G.A.)

OKLAHOMA (Group 3)—

Zero to 10 Cold Test:		
150-3		.09
180-3		.10
180-4		.09½
200-3		.10⅛
200-4		.10
250-3		.11⅛
250-4		.11
280-3		.12⅛
280-4		.12
300-3½		.13
400-3½		.14
100-2½ paraffin oil		.06
15-20 Cold Test:		
200-3		.10
200-4		.09½
250-3		.11
250-4		.10½
280-3		.12
280-4		.11½

GULF COAST—

Pale Oils:		
200-3	.07	.07¼
300-3	.07½	.07¾
500-3½	.08⅛	.08⅜
750-3½	.08⅝	.09⅛
1,200-3½	.09⅛	.09¾
1,500-4	.09¾	.10
Red Oils:		
200-5-6	.07¼	.07½
300-5-6	.07¾	.07½
500-5-6	.08	.08½
750	.08¾	.09
1,200-5-6	.09¼	.09½

CALIFORNIA (moving to dom. market)—

Pale Oils:		
100-2½-3	.07¼	.08
200-2½-3	.07¼	.08
300-2½-3	.07¼	.08
400-3-4	.07¾	.08
450-3-4	.07¼	.08
550-3-4	.09	.11
600-3-4	.09	.11
Red Oils:		
200-4-5	.07¼	.08
300-5-6	.07¼	.08
350-5-6	.09¼	.11½
400-5-6	.09¼	.11½
450-5-6	.09¼	.11½
500-5-6	.09¼	.11½
600-5-6½	.09¼	.11½
700-6½ plus	.09¼	.11½
750-6½ plus	.09¼	.11½
900-6½ plus	.09¼	.11½

PENNSYLVANIA—

150 vis. at 70° F. color, 400-405 flash:		
Zero pour test	.17½	.18
10 pour test	.16½	.17
15 pour test	.16	.16½
25 pour test	.15	.15½
180 vis. at 70° F., 3 color:		
25 pour test	.16	.16½
200 vis. at 70° F., 3 color:		
Zero pour test	.20½	.21
10 pour test	.19½	.20
15 pour test	.19	.19⅛
25 pour test	.17	.17½

Wax and Petrolatum

(Prices per pound)

OKLAHOMA (Group 3)—

124-126 (a.m.p.) w.c. scale	.02½	.02⅝

PENNSYLVANIA (Inland refineries)—

122-124 (a.m.p.) w.c. scale	.0220	.0225
124-126 (a.m.p.) w.c. scale	.0220	.0225

NEW YORK—

Wax in bags fully refined:		
122-125 (a.m.p.) wax		.0445
125-127 (a.m.p.) wax		.0455
128-130 (a.m.p.) wax		.0480
130-132 (a.m.p.) wax		.0505
133-135 (a.m.p.) wax		.0535
135-137 (a.m.p.) wax		.0560
124-126 (a.m.p.) w.s.	.0295	.0300
124-126 (a.m.p.) y.s.	.0265	.0280
Petrolatum in barrels, carload lots:		
Dark green		01⅞
Amber	.02⅞	.03
Extra amber	.03	.03⅛
Lily white	.06⅝	.06¾
Snow white	.07¾	.07⅞
Cream	.05⅝	.05¾

Export Prices

GASOLINE

GULF COAST—

U. S. Motor	.05	.05⅛
60-62 400	.05⅜	.05½
61-63 390		.05⅝
64-66 375		.05¾

LOS ANGELES—

U. S. Motor grades:		
55-65 octane	.05½	.05¾
65-69 octane		.06
Above 69 octane		.06¼

KEROSENE

GULF COAST—

41-43 prime white	.04⅞	.05
41-43 water white	.05	.05½
44 water white	.05⅜	.05½

LOS ANGELES—

41-43 water white	.05	.05¼

LUBRICANTS

(Pennsylvania Grade)

NEW YORK (f.o.s. in bbls.)—

Cylinder Stocks:		
600 Warren E	.21½	.22
600 S.R. unfiltered	.16½	.17
630 S.R. unfiltered	.21	.21⅛
600 flash, S.R.	.21½	.22
630 flash, S.R.	.25½	.26
Bright Stocks:		
8 color	.23½	.24
6½ plus color in dilution	.23	.23½

NEUTRAL OIL

200-3 color	.30	.30½
150-3 color	.25½	.26

PARAFFIN WAX

NEW YORK (prices per pound)—

123-126 a.m.p.		.04125
125-127 a.m.p.		.0425
128-130 a.m.p.		.0450
133-135 a.m.p.		.0525
135-137 a.m.p.		.0550
Crude Scale:		
124-126 w.s.	.0295	.0300
124-126 y.s.	.0265	.0280

DRILLING ABROAD

(Continued from Page 63)

tween Rio Sogamoso and Rio Librija on the Restrepo concession and the company is now engaged in drilling a deep well with diesel rig.

Seventy wells were completed on Tropical De Mares concession during 1937 and 65 were commercial producers yielding an average of 508 bbls. of oil per day.

VENEZUELA

By C. C. McDermond, Maracaibo, Venezuela

Bachaquero and Pueblo Viejo, two fields south of Lagunillas in the Lake Maracaibo district, are scheduled for intensive development in 1938 along with exploitation of Tia Juana, Mene Grande, Lagunillas, La Rosa-Ambrosia, Los Manueles, Tarra, Quiriquire, Cumarebo, Pedernales and, to an unknown extent so far, eastern Venezuela.

There were 512 wells completed in Venezuela in 1937, falling 83 short of the peak year in this respect, established in 1929. Drilling programs of the more important companies operating in Venezuela indicate 1938 will establish a new all-time peak in new completions.

Two Venezuelan fields, Los Manueles and Tarra, had their first new activity in 1937 since 1934. Colon Development Corp. completed one well in the Los Manueles field capable of producing 1,965 bbls. of 26.5-degree A.P.I. oil from total depth of 4,068 feet. In Tarra, Colon operated one string of tools on new drilling and another on clean-out work, materially boosting production from the field toward the end of the year.

At the end of 1937, Venezuela was credited with 2,491 producing oil wells. Of the total, 1,291 were pumping and 278 were on air- or gas-lift and the remainder were flowing.

Venezuela produced 186,653,916 bbls. of crude in 1937 compared to 155,228,982 bbls. in 1936. Out of the total production, Lagunillas accounted for 45.6 per cent; Tia Juana, 14.3 per cent; Quiriquire, 14 per cent; La Rosa, 13.3 per cent; and Mene Grande 7.6 per cent. Standard Oil Co. of New Jersey subsidiaries, Lago and Standard of Venezuela, accounted for 48.3 per cent of the production; Shell companies, including Caribbean, Venezuela Oil Concessions and Colon produced 37.4 per cent, and Mene Grande, Gulf subsidiary, 14 per cent. Smaller amounts were produced by British Controlled Oilfields, Ltd.

The intensive wildcat drilling program in eastern Venezuela continued at an accelerated rate in 1937 and approximately 20 or 25 tests were drilled to suspension or abandonment depths in Monagas, Anzoategui and Maturin.

Outstanding development at end of the year was the deal between International Petroleum Co. and Mene Grande Oil Co. by which the former will accept delivery on production from the latter in Venezuela in excess of its own requirements.

RUMANIA

Most important development of 1937 in Rumania was discovery of deep production from the Meotic in the Tintea field and along the south of the salt ridge between Baicoi and Tintea. Completions registered during the latter part of the year indicate high production and the competitive nature of the program argues for a material increase in output for 1938.

Rumania produced 54,142,600 bbls. of crude in 1937, a decline of 10,319,636 bbls. compared to 1936, a drop of 15.9 per cent. The production decline was registered despite drilling of 1,300,000 feet of hole, an increase of 220,000 feet compared to 1936. Manesti was the only new field discovered during the year, but its production so far is confined to gas from three completions.

Important wildcat tests were drilled at Podenii Vechi and at Brostesti, but operations failed to develop production. Decline of the Bucsani field continued in 1937 following its peak performance early in 1936 and it is no longer regarded of outstanding caliber.

In the Moreni area, active development was prosecuted and available locations on the south flank were drilled, as was the new area opened in 1936 at North Piscuri. Meotic has proved productive over a larger area than first anticipated.

A proposed modification of the Rumanian prospecting laws which would permit the successful explorer to retain for exploitation all land proven up to 6,000 acres, if situated more than 20 kilometers from a field, is now under consideration. If the modified law is enacted, it is expected to stimulate exploration in Rumania.

PERU

By O. B. Hopkins, Chief Geologist, Imperial Oil Co., Ltd.

Although 47 new producers were added on the La Brea-Parinas estate in Peru out of a total of 57 completions in 1937, the crude output declined slightly from 17,593,700 bbls. in 1936 to 17,466,620 bbls. Tardy arrival at Peru's all-time peak production in 1936 was explained by Mr. Hopkins as due to complexity of structural conditions within the proven fields.

Outside of the proven fields, the government carried out an active exploratory program in 1937 and probably will continue much of its work in 1938. The producing fields are La Brea, Parinas, Lobitos-Restin and Zarritos, all in northwestern Peru.

The government is reported to have carried on some drilling in the northern province of Tumbes and its engineers were active in Pusi and Saman. It is planned to drill exploratory tests near Pirin this year.

Active consideration is being given to a waterflooding project in older parts of the La Brea-Parinas estate. Two wildcats drilled in the northern part of the estate in 1937 were failures.

One of the wildcat projects launched in 1937 was that of Compania Petrolea El Ganso Azul, which acquired interest of Selden Breck Co., consisting of about 90,000 acres along the Pachitea River, a few miles above its confluence with the Ucayali River.

On the La Brea-Parinas estate alone a total of 141,653 feet of new hole was drilled, 129,516 feet in new wells and 12,137 feet in deepening old holes. Rotary drilling became even more popular in 1937. Thirty-one of the 57 wells drilled in the La Brea-Parinas estate used rotary equipment.

Several good wells were completed on the El Alto, or northern section of the Lobitos field during the year. The Lobitos field produced 2,693,866 bbls. in 1937, an increase of 275,668 bbls. over 1936.

POLAND

By Prof. C. Bohdanowicz

New drilling in Poland in 1937 was confined largely to extension of old fields in the Jaslo district and to a lesser degree in the Stanislawow area. Deepening of old wells gave better results than new drilling. Discovery of two new fields, Targowiska and Czarna, increased reserves slightly.

The new gas line, 12-inch from Roztoki to Sandomierz and 10-inch from Ostrowiec to Starachowice, totaling 280 kilometers, is to be extended this year to Radom with branches to Rzeszow and Rozwadow.

To maintain Poland's production and attain an increase of 10 per cent in 1940, engineers believe drilling must be increased to about 492,000 feet in 1938; about 738,000 feet in 1939, and to about 1,575,000 feet in 1940. The figures are based on requirements for about 380 new wells in 1938 and about 800 in 1940.

The large Polish oil firms, including Malopolska, Galicia, Limanowa and Standard-Nobel, produced 59.4 per cent of 1937 output principally in the Boryslaw, Bitkow and Rypne fields. Smaller firms operating in Poland are credited with 34.8 per cent of the production and did 53.3 per cent of the drilling in 1937. Poland contained 3,530 wells at the end of the year, compared to 3,358 at the end of 1936, distributed as follows: 1,401 in the Jaslo district, 1,001 outside Boryslaw; 711 in Boryslaw and 417 in Stanislawow.

An extensive prospecting program was carried on by the Polish Geological Survey in the plains of northern and western Poland using magnetometer and gravimeter. Regional magnetometric surveys covered 40,000 square kilometers and detail was worked on 350 square kilometers. The gravimeter has been used in covering 6,000 square kilometers in the eastern sector of Poland's lowlands and 5,000 square kilometers were covered in the western sector. Fifty new anomalies were found in the Holy Cross Mountains by pendule. Seismic surveys were carried out by Pionier Co. between the Vistula and San rivers covering 1,750 kilometers of cross section. Eighty kilometers of cross section were worked in the Central Carpathians. Pionier, formed in 1928 by 11 of the large oil companies for joint exploration purposes, has defined a structure between Daszawa and Nowy Sambor. Late in 1937, a well in Opary encountered gas at 395.5 to 399.5 meters which may open a field. The concern holds considerable acreage in the general area.

TRINIDAD

Crude production in Trinidad during 1937 totaled 15,498,350 bbls., a daily average of 43,350 bbls., compared to a total of 13,237,030 bbls. in 1936. An important factor in boosting production to this all-time peak was completion of 251 wells. There were 15 wells abandoned, including failures and depleted producers. There are 800 wells in Trinidad temporarily shut down, leaving a total of 1,235 active. Most of the wells are pumping, the total being reported at 491. There are 395 flowing wells and 97 are producing by air- or gas-lift.

At the end of the year it was estimated Trinidad's oil fields covered 13,275 acres. Accumulative recovery to the end of 1937 is set at 145,076,700 bbls.

U.S.S.R.

Inability of the Soviet oil industry to meet more than 84 per cent of its planned production for 1937, despite the discovery of numerous apparently prolific producing areas, is due largely to the lack of equipment and transportation.

The review of new fields discovered in the year followed reviews previously published in The Oil and Gas Journal by W. M. Kemnitzer, who attended the World Petroleum Congress last summer in Moscow.

There are approximately 7,000 out of 12,000 wells in the U.S.S.R. reported idle due to lack of equipment and the inclination of Soviet engineers to pass up producing smaller units in the interest of drilling and completing those capable of flowing. There is reported to be an especially acute need for tubular goods, with tubing and rods practically unprocurable.

More than 77 per cent of the U.S.S.R. production is contributed by the Baku fields.

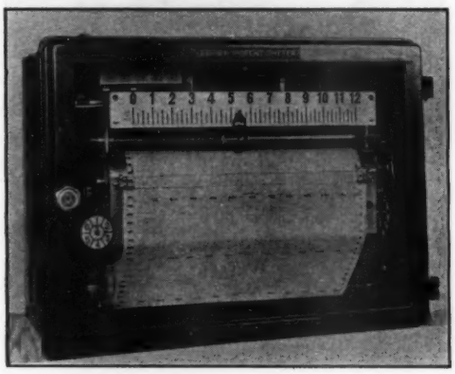
L. F. McCollum, executive vice president of the Carter Oil Company, Tulsa, went to New York for a conference with officials of the Standard Oil Company of New Jersey.

Joseph Jensen, Los Angeles, chief petroleum engineer for Tide Water Associated Oil Company (Associated Division) left last week for a tour of inspection of the San Joaquin Valley fields, making his headquarters in Bakersfield.

New or Improved Equipment

Simple Design and Ruggedness Mark New Brown Instrument

Features of the Brown multicolor numeral printing potentiometer pyrometer announced by the Brown Instrument Co., Philadelphia, Pa., include simplicity of design, ruggedness and dura-



bility. This multiple potentiometer recorder is designed to insure precision measurement of temperatures and to provide a more legible record in both multicolor and numerals. With this method of recording several temperatures on one chart where temperature changes overlap, no special skill is required to decipher the multicolor numerals.

Only one symbol, the plus sign, is used and the numeral identifies the thermocouple from which the temperature record is being made. The plus sign has definite, practical significance in multiple temperature recording. Its vertical line identifies the temperature and the horizontal line the time coordinate. The intersection of the two lines locates the exact point of the time-temperature record.

The 12-inch chart and the distinct imprint of the unique number print wheel makes it possible to record continuously from two to six temperatures from as many different thermocouples. The Brown multiple recording potentiometer pyrometer, has the features of the standard Brown potentiometer pyrometer, including the 40-inch slide wire, enclosed galvanometer, rugged drive mechanism, synchronous motor, etc.

Here and There With Men Who Manufacture Equipment

Recent developments in prospecting, new methods and equipment, production and transportation of crude oil, new processes for refining oil, and new research and testing methods for oil qualities were subjects of an informal discussion led by Dr. Paul D. Foote, executive vice president of the Gulf Research & Development Co., at a recent meeting of the Jones & Laughlin Aliquippa Engineer's Institute of the Jones & Laughlin Steel Corp. in Pittsburgh, Pa.

P. W. (Steve) Aular, designing engineer for the Titusville Iron Works Co. for several years, is now with the United Supply & Manufacturing Co., Tulsa, in an engineering and sales capacity.

E. T. Campbell, formerly assistant manager of petroleum sales at the Akron, Ohio, headquarters of the B. F. Goodrich Co., has been transferred to New York as assistant manager of petroleum sales in the eastern division. He succeeds William Sewall, recently named manager of the petroleum sales department. Morris A. Starr, Atlanta, Ga., petroleum sales representative, takes Mr. Campbell's place in Akron, and is succeeded by E. H. Fitch as Atlanta representative.

The Carnegie-Illinois Steel Corp. has appointed G. Reed Schreiner advertising manager. Mr. Schreiner, who has been assistant advertising manager, succeeds Charles R. Moffatt, recently appointed director of advertising of the United States Steel Corp. of Delaware.

J. Warren MacClatchie, president of the MacClatchie Manufacturing Co., Compton, Calif., recently entertained oil men with a barbecue at his Double V ranch, at Saugus, Calif. Wyoming elk and pig from the MacClatchie ranch were the main dishes.

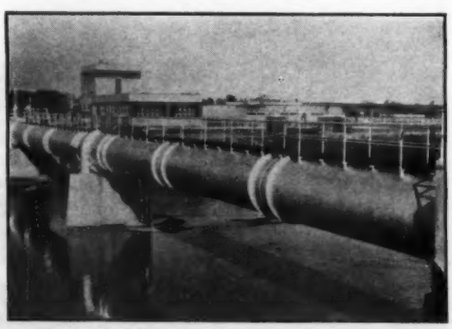
W. L. Walker, of the W. L. Walker Co., Tulsa, is on his annual trip to California, calling on the trade through North and West Texas on his trip out, and on the South Texas trade on his return. An addition to his oil thief is a specially treated rope equipped with brass ferrule markers, which allows the gauger to determine the depth of the thief in the tank at all times.

Bovaird Supply Co. Represents Regan in Oklahoma

The Oklahoma representative of the Regan Forge & Engineering Co., San Pedro, Calif., is the Bovaird Supply Co., with main offices in Tulsa. In Regan's advertisement, appearing elsewhere in this issue, the name of the Oklahoma representative is in error and this item is intended to correct this situation.

World's Longest Pipe Span

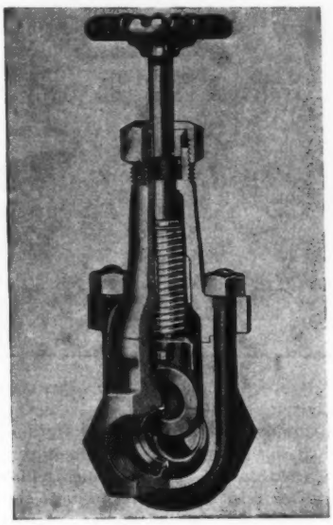
Until the two spans shown in the illustration were constructed, a pipe span of 100 feet was unheard of. These spans are each 105 feet long. The structure carries sewage across the Platte River to the new disposal works in Den-



ver, Colo. This is said to be the longest unsupported span of pipe in the world. The principle involved is that of preventing distortion at the points of support by welding stiffener rings to the pipe. These rings transmit the load to the foundation by means of legs. The pipe was designed, fabricated of copper molybdenum iron by electric welding, and erected by Thompson Manufacturing Co., Denver. This picture is shown by courtesy of Lincoln Electric Co., Cleveland, Ohio.

Relief Slots to Prevent Freezing in Fairbanks U-Bolt Valve

The new Fairbanks U-bolt gatevalve, introduced by Fairbanks Co., Binghampton, N. Y.,



has features which the manufacturers say make it of special value in the oil industry.

Relief slots in the threaded bonnet bushing permit drainage back into the body chamber to prevent freezing or clogging above the bonnet-threads. A U-bolt locks the body and bonnet firmly together, making a pressure-tight joint and adding strength to the body. By removing only two nuts the valve can be disassembled.

The stuffing-box, of extra depth, contains an ample supply of asbestos ring packing. It is fitted with a heavy follower gland and a large hexagon packing-nut. The body and bonnet are made of liberally proportioned and uniform-thickness chrome-nickel alloy high-test iron or semisteel having an average tensile strength of 40,000 pounds per square inch.

A double-taper wedge with knife edge at the bottom cuts through heavy fluids or sediment. Foreign matter is forced from the bottom of the wedge chamber where it can flow through the line. When fully open the wedge is above the flow. Extra-length pipe-threads prevent long threaded pipe or nipples from damaging the diaphragm, seats or wedge. A bronze nut, holding the wheel, is below the wheel-rim surface, thus protecting the hand. It is held securely with a lock washer.

The protected top seat above the stem threads makes a tight joint with the large seat under the stuffing-box. The valve can be repacked under pressure when fully open without leakage. It prevents sediment from reaching and scoring the seating surface. The cast-in bronze bushing (in bronze mounted type) provides a noncorrosive contact with the stem. It prevents corrosion and excessive wear, and protects the stem-threads.

Jarecki in New Quarters

Business has continued without interruption at the Chase, Kans., store of the Jarecki Manufacturing Co. in spite of the recent fire which resulted in a total loss. Headquarters have been moved from their temporary location in a boxcar to the new building, which houses a complete stock, according to Paul Warmbrodt, manager.

Portable Device Regrinds Ball and Seat Valves in Field

The portable machine illustrated is offered to oil producers for reconditioning ball and seat valves in the field. Introduced several months ago it is said to be making excellent records with large oil-producing companies, in grinding new or regrinding used ball and seat valves. It is eco-

nomical in operation, accurate in adjustments and convenient to handle, as it can be operated by regular employes who have a working knowledge of oil-field machinery. The manufacturer is said to have field records of companies which after becoming familiar with the machine's operation, have reconditioned 100 ball and seat valves in an 8-hour day. More detailed information can be obtained from the Ball Valve Seat Grinder Co., 204 North Beech Street, Syracuse, N. Y.

Davis Rocky Mountain Agent

The American Sand-Banum Co., Inc., 9 Rockefeller Plaza, New York, has made M. C. Davis its Rocky Mountain states representative. Mr. Davis will carry a stock of Sand-Banum, for boiler and engine treatment, in Casper, Wyo., where he will make his headquarters so that customers in that area can be immediately served.

Bulletins, Booklets and Other Literature for the Trade

Developments and refinements accomplished in over 30 years of manufacturing direct-connected synchronous-motor-driven compressors, are presented in a 56-page catalog covering class "PRE" compressors, issued by the Ingersoll-Rand Co., 11 Broadway, New York.

The Mixing Equipment Co., Rochester, N. Y., has ready for mailing a bulletin on its new "Bearing Guard" mixer, designed to protect bearings from damage by corrosive or abrasive materials used in a tank.

"Wire Rope's Natural Enemies," recently published by Hazard Wire Rope Division of American Chain & Cable Co., Inc., Wilkes-Barre, Pa., is a treatise on the many things that wear out rope and how either to avoid them or minimize their effect. Sheaves, reverse bends, kinking, whipping, abrasion and other enemies of wire rope are discussed.

Maximum and rated performance curves of the seven current sizes of "Caterpillar" diesel engines are included in a new booklet issued by Caterpillar Tractor Co., Peoria, Ill. Outstanding features of diesels manufactured by the company are presented.

"The Neoprene Notebook," issued by the Rubber Chemicals Division, E. I. du Pont de Nemours & Co., is planned to give the engineer and the manufacturer engineering information, laboratory data, and application reports on neoprene so that they will have this material readily available when considering their next application.

Armco-National spiral-welded surface casing is described and illustrated in a bulletin available from National Tank Co., Tulsa.

Water and liquid-level gauges of bronze, malleable iron, and steel are covered in a new catalog prepared by Penberthy Injector Co., Detroit, Mich.

A bulletin entitled "Graphical Vapor Pressures" describes a machine manufactured by Industrial Engineers, Inc., 819-A East Fifty-ninth Street, Los Angeles, Calif., which measures and records the vapor pressure of liquids.

International in New Towns

International Supply Co. has established a new store at Kemp City, Tex., in the heart of the K.M.A. field, and its Ada, Okla., store has been moved to Fittstown, Okla. The Kemp City store is 13 miles south of Electra and 22 miles southwest of Wichita Falls. P. J. Ryan is manager of the Kemp City store. M. L. Creed, who was in charge at Ada, has been transferred to Fittstown.

Smith Separator Distribution

The Parkersburg Rig & Reel Co., Parkersburg, W. Va., which became exclusive distributor of Smith separators January 1 of this year, has announced plans for improvement in the distribution and servicing of this line. Stocks and service are available in Houston, Corpus Christi, Odessa, Willow Springs, and Pampa, Tex., and Rodessa, La. Within the near future stocks and service will be available at convenient points in Kansas and California. Thereafter as conditions justify, they will be added at other points in Parkersburg's nation-wide warehouse system. Fields in Oklahoma are to be handled direct from the Smith plant in Tulsa.

Operates Supervisory Controls of Valve Nine Miles Away

This man is operating the supervisory controls of the valve of a natural gas main 9 miles away. Natural gas is conveyed from the Kettleman Hills

oil fields to the city limits of San Francisco in a main pipe line at a maximum pressure of about 230 pounds. A pressure-reducing station is required at the city line, because 60 pounds is the maximum pressure permitted within the city. A simplified two-wire Westinghouse supervisory control system, known as Polaricode, Jr., makes it possible for a remote operator to adjust the motor-operated valve at the city-line regulating station so as to maintain constant pressure on the low-pressure side. In addition the supervisory control provides him with an indication of the valve position whether he operates the valve or not, and also furnishes a continuous indicating and graphic record of the pressure on either side of the valve. This control makes it possible, during off-peak periods, to pack the 22-inch, 45-mile gas line from the Kettleman Hills oil fields to the city line. This is the equivalent of adding another large size gasholder to the system.

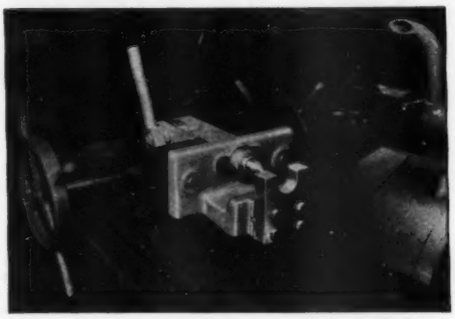
DOWELL EXECUTIVES LOOKING FOR PROSPEROUS YEAR

Dowell, Inc., oil and gas well chemical service subsidiary of Dow Chemical Co., held its annual executive meeting at the plant of the parent company in Midland, Mich. A prosperous year for the oil and chemical industries was forecast.

Organized in 1932 as the result of experimental work in acidizing the brine wells in Midland, Mich., Dowell, Inc., now operates 23 stations throughout the United States and services every lime producing area in the country.

Holding Fixture Is Designed to Attain Greater Accuracy

The odd shape of many threaded parts frequently requires a special holding fixture in order that production standards may be maintained for the threading operation. The fixture illustrated was designed by engineers of Landis Machine Co., Inc., Waynesboro, Pa., for use by one of the large motor-car manufacturers on the Landmaco threading machine. It provides an efficient and



rapid method of accurately locating the work to assure perfect concentricity between the thread and the work.

This attachment consists of a special traveling center, not shown in the photograph, a driving-block and a locking center. The traveling center is located in the bore of the head to support the front end of the work, and eliminate any possibility of the chasers leading off center. A long heavy spring, also in the bore of the die-head spindle, maintains a constant pressure of the center against the work.

The second center, located on the carriage directly back of a steel block which is cut out to conform to the shape of the work it is to hold, provides the remainder of the supporting, and also locking action to the work. This center is supported in a short spindle, the opposite end of which operates against a cam. The cam is mounted on a shaft at right angles to the spindle. One end of the shaft is milled to a hexagon shape and is fitted with a short handle. If necessary, the handle may be quickly removed and relocated on the shaft in a conveninent operation position.

Twin Disc Branch in Dallas

The Twin Disc Clutch Co., Racine, Wis., manufacturer of clutches, power take-off units and reduction gear units used extensively in the oil field, has established a new factory branch in Dallas, Tex. This branch, under the direction of J. B. Jenkins, is at 2826 Main Street. A complete stock of replacement parts will be carried on all special equipment used throughout the oil industry. Special oil-field engine service, data and assistance will be offered to the engineers and operators in this field.

Lummus Office for West Coast

Dr. E. R. Smoley has been placed in general supervision of Pacific Coast headquarters which Lummus Co., designer and erector of oil-refining plants, announces it has established at 411 West Fifth Street, Los Angeles. Doctor Smoley recently represented Lummus in connection with the design of a 14,000-bbl. combination selective cracking unit which the company is constructing for General Petroleum Corp. at its Torrance refinery. He spent three years in the Far East in charge of all technical work for the Standard Oil Co. of New Jersey. He is now in Los Angeles working out details for the West Coast representation. V. O. Bowles, engineer, who is in direct charge of the new office, is a native Californian and a Stanford graduate. He later graduated from M.I.T. with a master's degree in chemical engineering. For three years he was in the refining department of Humble Oil & Refining Co. in Houston, Tex.

Marmon-Herrington's 1938 Line of Vehicles Has 56 Models

The 1938 Marmon-Herrington line of all-wheel-drive vehicles includes 56 models, according to announcement by the Marmon-Herrington Co., of Indiapanolis, Ind. In addition to the regular line of more than 30 extra-heavy-duty trucks, trailer-tractors, etc., the company converts all Ford trucks and commercial and passenger cars for all-wheel-drive in its Indianapolis plant.

Outstanding advances have been made in all-wheel-drive construction in the 1938 models. Full utilization of power and efficient traction in every wheel allow them to haul more and heavier loads, on and off the highway.

The all-wheel-drive mechanism in the 1938 models includes a driving front axle, two-speed auxiliary transmission, front propeller-shaft, special front springs and other parts proved in years of experimentation and testing. Marmon-Herrington all-wheel-drive Ford V-8 trucks and the regular Marmon-Herrington models have positive control under all operating conditions. Engine power is utilized fully through front wheels as well as rear.

Fields Now Vice President

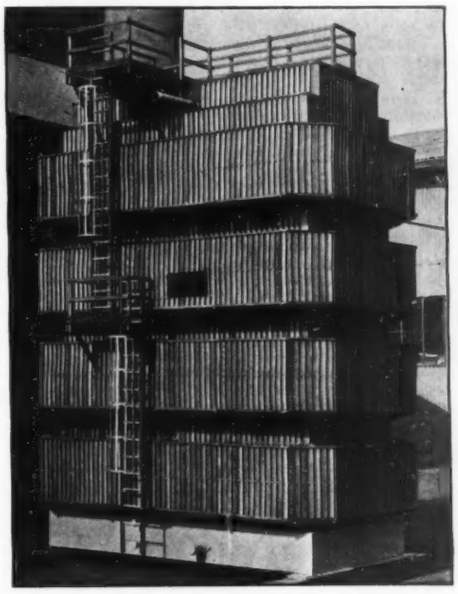
The Tulsa Boiler & Machinery Co. at its annual meeting announced that D. E. Fields had been made a vice president. Mr. Fields has been with the company since his graduation in 1925 from the school of mechanical engineering of the University of Oklahoma. He is chief engineer and in charge of sales. He is a registered professional engineer and a member of the Engineers Club and the Tulsa Club.

FIRE HAZARDS HELD DOWN

One of the largest producers in the Kansas oil country is being pumped by a Hercules low-fire-hazard engine especially adapted for oil-field applications. The engine, installed on the property of the British American Oil Producing Co. in the Bemis pool, took 3,276 bbls. of oil from the well in a 24-hour test, one of the heaviest potentials ever taken in Kansas. The Hercules engine, an RXB low-fire-hazard model, is attached to a Lufkin twin-crank pumping unit. Natural gas, supplied on the British American lease, is used for fuel. The engine is adapted for either gasoline or natural gas. Fire hazard is held at a minimum by flame arrestors and effective shielding of the ignition system.

Models of Fluor Tower Go to Eight Engineering Schools

Interest shown by engineering school faculties and students in modern industrial water-cooling methods has prompted the Fluor Corp., Ltd., Los



Angeles, Calif., to build and present working models of the Fluor standard 4A12 aerator-type atmospheric cooling-towers to eight nationally known and universally recognized engineering schools.

Accurate in every detail, the working models simulate actual Fluor cooling-towers in every respect. It was believed models of cooling-towers which would react in the laboratory just as they would in the field would be of great value not only for cooling purposes in the laboratory, but to permit students to avail themselves of first-hand knowledge of cooling methods practiced by industry in the field.

In cooperation with the Pacific Lumber Co., which donated all the redwood; the Crane Co., which donated pipe and fittings, and Chase Brass & Copper Co., which donated copper and brass, Fluor engineers developed the models to quarter scale of their standard tower. The models are 4 feet 6½ inches by 7 feet 6½ inches and are 10 feet high. Each weighs 1,200 pounds. Tests proved to the satisfaction of company engineers that the model tower would perform just as standard towers in the field.

Filter-Cloth for Industrial Use Is Composed Wholly of Glass

Fiberglas, a filter-cloth made entirely of glass, is now offered for industrial filtration and clarification by Filter Media Corp., Irvington-on-Hudson, N. Y. This product is said by the manufacturer to solve the problem of filtering hot or cold acid and solutions because it is not only strong mechanically but durable chemically. While it is 100 per cent glass, it is so well woven that it functions as would any filter-cloth made from cotton, wool or metal.

The glass cloth is manufactured in 7 different weaves and weights, each in 26-, 32-, and 38-inch widths. The manufacturer says that it is as resistant as chemical glass to attack from all hot or cold acids except hydrofluoric; that it withstands temperatures up to 500° F.; that its strong and pliant individual fibers, being inert, do not swell or otherwise change; that it is easily cut to fit shapes of different filter elements, and readily sewed with glass thread.

Oil Man's Calendar

February

26—Wichita Falls, Tex., eighth annual banquet, North Texas Oil and Gas Association.

March

2-3—Indianapolis, Ind., Indiana Independent Petroleum Association, spring meeting.

2-4—Des Moines, Iowa, Iowa Independent Oil Jobbers Association and Trade Exhibit, Fort Des Moines Hotel.

7—Rochester, N. Y., American Society for Testing Materials, Spring Regional Meeting and Group Committee Meetings.

14-16—Toronto, Ontario, annual meeting of Canadian Institute of Mining and Metallurgy.

15-17—New Orleans, La., annual meeting, Society of Exploration Geophysicists, Roosevelt Hotel.

16-18—New Orleans, twenty-third annual meeting, American Association of Petroleum Geologists, Roosevelt Hotel.

21-22—Oklahoma City, Oklahoma Utilities Association.

21-22—St. Louis, Mo., Liquefied Petroleum Gas Association, annual meeting.

22-23—Sioux Falls, S. D., annual convention, South Dakota Independent Oil Men's Association, Cataract Hotel.

21-25—Los Angeles, Calif., American Society for Metals congress and exposition, Pan-Pacific Auditorium.

23-25—Los Angeles, Calif., American Society of Mechanical Engineers.

24-25—Fort Worth, Tex., American Petroleum Institute, Division of Production, spring meeting, southwestern district, Blackstone Hotel.

April

4-6—Cincinnati, Ohio, A.G.A. Distribution Conference, Netherland Plaza.

13-15—Cleveland, Ohio, National Petroleum Association.

13-15—Houston, Tex., Petroleum Industry Electrical Association.

14-15—Pittsburgh, Pa., Eastern District A.P.I. Division of Production, William Penn Hotel.

17-21—Dallas, Tex., American Chemical Society.

19—Los Angeles, Spring meeting, Pacific Coast district, A.P.I. Division of Production, Biltmore Hotel.

19-21—Norman, Okla., Gas Measurement Short Course.

20-22—Buffalo, N. Y., American Institute Mining and Metallurgical Engineers, Open Hearth Conference.

25-27—Hot Springs, Ark., Western Petroleum Refiners Association, annual meeting.

May

9-12—New Orleans, La., Natural Gas Department, A.G.A.

11-13—Tulsa, Natural Gasoline Association, Hotel Tulsa.

12-14—Tulsa, National Oil Scouts Association of America.

14-21—Tulsa, International Petroleum Exposition.

23-25—Wichita, Kans., American Petroleum Institute, eighth midyear meeting.

27-28—State College, Pa., seventh annual conference, School of Mineral Industries, Pennsylvania Grade Crude Oil Association and Pennsylvania Natural Gas Men's Association.

June

4—Robinson, Ill., sixth annual Petroleum Conference of Illinois-Indiana.

6—Houston, Tex., Oil Workers International Union.

16-18—Pittsburgh, Pa., Pennsylvania Grade Crude Oil Association.

20-24—St. Louis, Mo., American Society of Mechanical Engineers.

June-July

27-1—Atlantic City, N. J., annual meeting of American Society for Testing Materials.

August-September

31-3—Spokane, Wash., Pacific Coast meeting of American Institute of Electrical Engineers.

September

14-16—Santa Barbara, Calif., annual meeting Pacific Coast Gas Association, Biltmore Hotel.

October

——Tulsa, I.P.A.A., annual convention.

6-8—Knoxville, Tenn., fall meeting of industrial minerals division of American Institute of Mining and Metallurgical Engineers.

10-14—Chicago, National Safety Congress, Stevens Hotel.

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THE OIL AND GAS JOURNAL
Tulsa, Oklahoma

CLASSIFIED ADVERTISING

For Sale—Equipment For Sale—Equipment For Sale—Equipment

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25 K.W. and 40 K.W. Gas Engines, 220 volts, D.C. Two 100 K.W. Gas Engine-Generator Sets, 220 volts, D.C. 7x6 Ingersoll-Rand ER-1 Air compressor, Six-inch Oster Pipe Threading Machine. Also large stock of lathes, pipe machines, milling machines, etc. Send for our list.
Terms to suit.
CINCINNATI MACHINERY & SUPPLY CO.
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TWO PUMPING UNITS
For Sale or Trade for any size pipe from ½" to 20"—Two Pumping Units Complete, each consisting of 100 H.P., 3-phase, 60-cycle, 2300 volt, 1750 R.P.M. Burke Motor, with G.E. 1034 Compensator and Starter, and 10" Worthington Centrifugal Pump; maximum capacity 3450 G.P.M.; maximum head at maximum capacity 90 ft.; also one Allis-Chalmers Centrifugal Pump, size 4", 350 G.P.M., 120 ft. head, 1750 R.P.M. All in A-1 condition and subject to inspection at our yard in Ft. Worth. Ph. 6-2713.
C. O. Hutchison Pipe & Supply Co.,
FORT WORTH, TEX.

FOR SALE—Two Rotary Drilling Rigs in West Texas and New Mexico. Herschbach Drilling Company, Dallas and Kermit, Texas.

DIESEL EQUIPMENT: Now operating; 1200 H.P. Engine with Clutch. 550 H.P. Engine direct connected to 375 KW 250 volt D.C. Generator. F. MAYER, 608 S. Dearborn St., Chicago, Ill.

DRILLING RIGS, drill pipe, boilers and any kind of used rotary drilling equipment immediate delivery. Write, wire or phone M. ROSENBLOOM PIPE & SUPPLY CO., 3538 Mansfield Road, Shreveport, La.

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FOR SALE — Askania Magnetometer complete with auiliary magnets and sensitivity coil. Gurley Explorers Alidade complete. These instruments are almost new and in perfect condition. M. L. C., P. O. Box 1470, Big Spring, Texas.

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Equipment Wanted

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Specializing leases twenty acres up dollar acre, East Tex., La., S. Ark. Owners—Attorney, Box 1122, Little Rock, Arkansas.

Leases and Drilling Blocks

TURN YOUR DEAL with our list of selected operators. Not major companies. Write Oil Industry Mailing List Co., 909 Tulsa Loan Building, Tulsa, Oklahoma.

YOUR money can earn 50%, 100%, 200% per annum without service or overhead expense. A monthly income for years. I give you a gas-proven lease, drill your well. Attend to all details. Ask me how. Mr. Buddenborg, Osawatomie, Kans.

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40 acres at a time.
Roy G. Barton, Clovis, New Mexico.

SECURITY ABSTRACT COMPANY
El Dorado, Arkansas
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on short notice. Ownership maps.

DRILLING DEAL WANTED
40 Acres in the Clay City Field, with production on four sides. Address Box J-170. The Oil and Gas Journal, Tulsa, Okla.

NEW MEXICO Oil leases for sale, inquiries invited. Write P. O. Box 507, Las Vegas, New Mexico.

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Leases to sell or trade? Need additional capital to expand your plans? Or perhaps you have potential oil lands to lease or sell outright, or wish to contact a responsible drilling contractor to take a part interest for developing.

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Refer to our rates on the preceding page. You will find these rates little, if any, more than those of your daily newspaper.

The Oil and Gas Journal
Classified Department
Tulsa, Oklahoma

Leases and Drilling Blocks

FOR SALE: Block of acreage near production on structure in Torrance Co., N. M. Address Box J-250, The Oil and Gas Journal, 1406 So. Grand Ave., Los Angeles, Calif.

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WILL DIVIDE block virgin Trenton Rock territory, for well. Operating cost low, prospects A-1. U. M. Shappell, Lima, Ohio.

10,000-ACRE Drilling Block in North Texas. Good Geology. Five-year leases. .50 delay rental. Good chance shallow production. Chester A. Farris, Arlington, Tex.

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Cookeville, Tenn.

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RANCH 668 acres, cattle, sheep, riding horses, farm and ranch equipment complete. On beautiful spring creek, good fishing. Large modern log house including furniture. Servant quarters, garage. Value $25,000. Trade for oil payment producing property. C. L. Yancey, Beacon Bldg., Tulsa, Okla.

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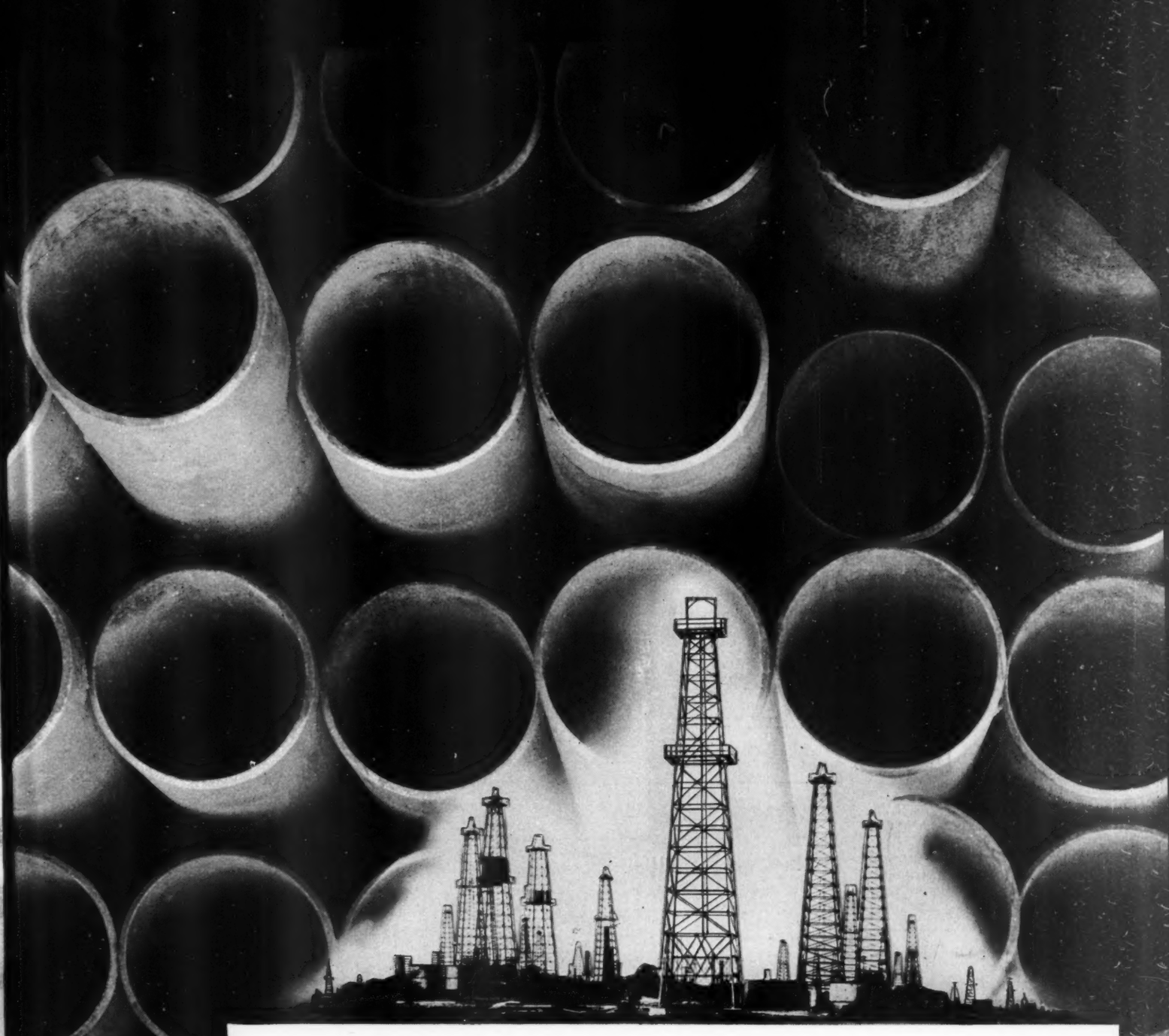

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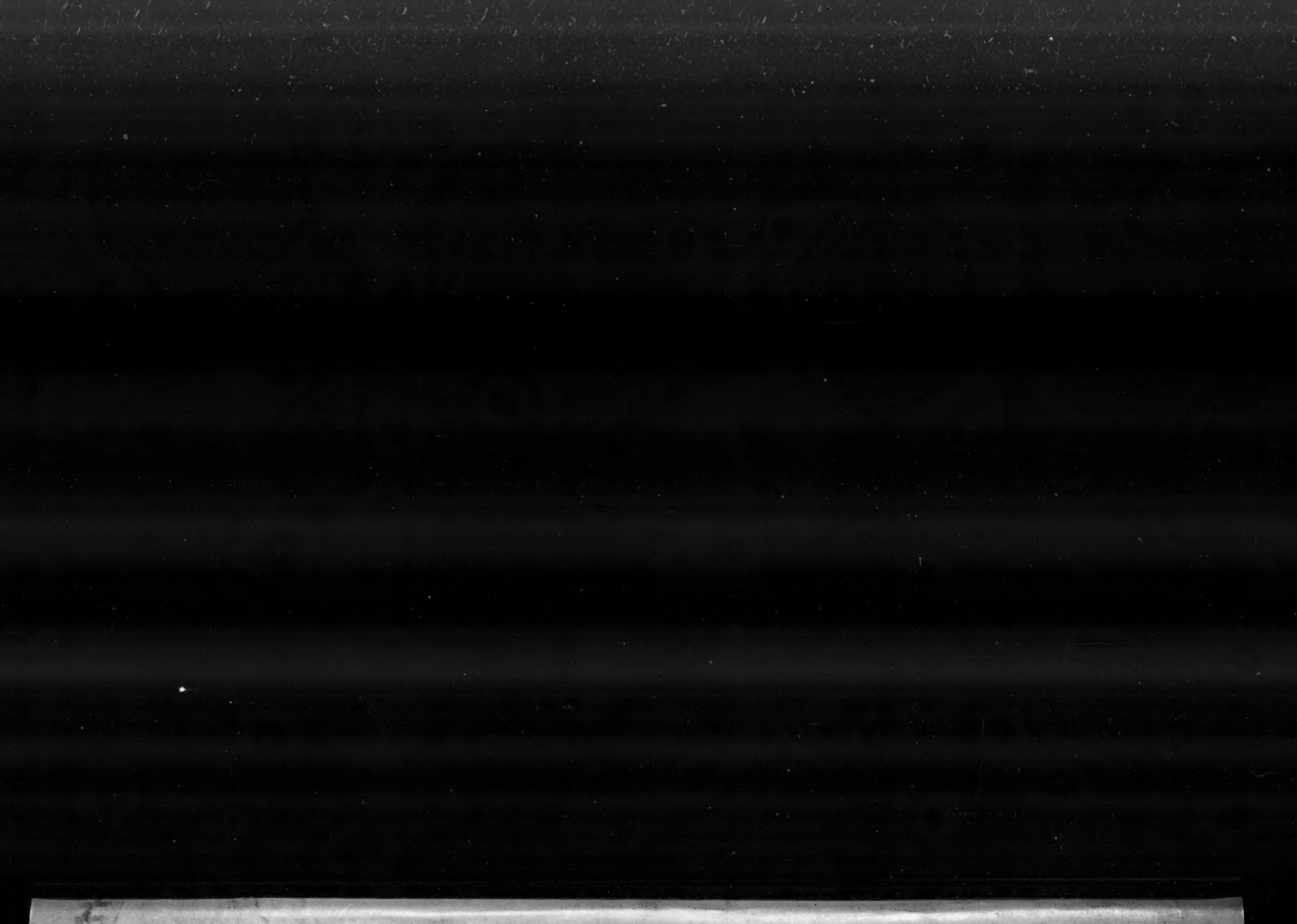
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